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**FISH BOWL SERIES**  
PROJECT OFFICERS REPORT—PROJECT 8A.1

**HIGH-ALTITUDE NUCLEAR DETONATION**  
**OPTICAL-INFRARED EFFECTS(U)**

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Air Force Cambridge Research  
Laboratories  
L. G. Hanscom Field  
Bedford, Massachusetts

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Page 53, Figure 3.11: DELETE: datum point at H + 20 seconds.

Page 127, Figure 3.85: DECREASE: ordinate scale by a factor 10.

Page 193, Figure 3.152: CHANGE: ".012w cm<sup>2</sup>" to ".012w/cm<sup>2</sup>".

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PROJECT OFFICERS REPORT—PROJECT 8A.1

HIGH-ALTITUDE NUCLEAR DETONATION  
OPTICAL-INFRARED EFFECTS (U)

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## CHAPTER 3

### RESULTS

Optical-IR radiation data were obtained on Shots Star Fish Prime, Check Mate, Blue Gill Triple Prime, King Fish, and Tight Rope from both aircraft stations and the Johnston and Maui Island stations.

The bulk of the Project 8A.1 data has been reduced and is presented in this chapter. The unreduced data will be presented in a subsequent AFCRL report. The type of data remaining to be reduced and a discussion of expected results is presented in Section 3.7 (Volume 3).

#### 3.1 GENERAL

3.1.1 Spatial Radiometer (Section 2.2.2). The spectral radiance observed by each channel for each shot is presented in graphical form as a function of time. In general, data are presented from approximately  $H + 25$  msec to as long as a signal above background was observed. No data on the initial pulse ( $H + 0.5$  msec to approximately  $H + 25$  msec) are shown.

The starting time for the data presented is the time at which the particular channel recovered from any saturation effects and when unsaturated chopped information appeared. Data are presented as long as the signal was

# SECRET RESTRICTED DATA



above the minimum detectable level for the channel under observation. The value for the minimum detectable level depended upon the exact conditions of data reduction and on the channel characteristics. The minimum detectable level was highest at early times (when data were reduced without the aid of the phase-sensitive amplifier system) and became progressively lower as the integrating time constants were increased in the phase-sensitive system. For this reason, there are occasional gaps in the data where the signal dropped below the minimum detectable level for the data reduction conditions existing at that time. Using a 2.0-second integration time constant the minimum detectable level for a high sensitivity channel was approximately  $5 \times 10^{-9}$  watt /cm<sup>2</sup>-ster-  $\Delta\mu$ . (As discussed in Appendix C,  $\Delta\mu$  indicates the band pass appropriate for either the Si or Ge filter and PbS detector combination.)

Figure 3.1 is an example of the raw data as it appears on an oscillograph trace. This figure shows the output of channel 3 of the system on Kettle I on Shot Star Fish Prime. The very short initial pulse with overshoot is evident at H + 0. Then there is very little signal until approximately H + 200 msec. At this time the chopped signal increases rapidly and then decreases again at later times.

The lower portion of Figure 3.2 shows the raw data from channel 21 of the system on Kettle II for King Fish. The upper portion shows the simultaneous output of the phase-sensitive amplifier system for the same signal. The gain in signal to noise through the phase-sensitive system is evident. Figure 3.3 shows the raw data from the low-sensitivity component of channel 21 of the system on Kettle II for King Fish. The data are shown on an expanded time scale.

Figure 3.4 shows the long-term chopped signal observed by channel 21 of the system on Kettle II for Blue Gill Triple Prime.

3.1.2 Filter Photometer (Section 2.2.3) . All figures in this chapter are reduced to apparent sky radiance ( $\text{watts/cm}^2$  -steradian in the filter band) meaning actual observed radiance as reduced by calibration minus the ambient radiance existing just before and after the event. For the purposes of comparison with results of other experiments, which may be represented in other units, it should be noted that these results were obtained with a field of view of 0.00158 steradian (5.0-micron photometer) or 0.0245 steradian (2.7-micron photometer). Pointing angles are described for each event in Appendix D.

### 3.1.3 PbS Radiometer (Section 2.2.7) and Photometer

(Section 2.2.12). The fluxes received by the radiometer and photometer are presented in multiples of the natural sky background flux with the approximate absolute fluxes indicated at some point on the graphs; this is done because the results do not include pointing corrections, window and atmospheric transmission corrections, and complete, final calibrations. It should be remarked that the signal-to-background ratio seen by a narrow-angle detector—such as would be used in tracking and surveillance systems—would be considerably higher than that received by these instruments, since the regions of sky which contribute most of the energy generally do not fill up their fields of view. Furthermore, the emitting areas do not have uniform surface brightness, and their point-to-point fluctuations, which are quite obvious in the photographs, could have deleterious effects on such systems.

3.1.4 Cameras. The photographs presented were chosen to show the evolution of the principal late features of each of the detonations. They constitute a very small fraction of the photometric-photography data on hand. (Note that the black-and-white photographs in the text have been

made from color negatives and have lost contrast and detail in the reproduction process.) The images of off-axis objects in these photographs are less bright because of vignetting by the fast, wide-angle lenses; this, as noted, was corrected for in the microdensitometry procedure.

### 3.2 SHOT STAR FISH PRIME

3.2.1 Spatial Radiometer (Section 2.2.2). During this measurement all channels on both systems operated as designed. The neutral density filter was employed in each system from  $H + 0$  to approximately  $H + 60$  seconds. This gave a system spectral response as shown in Figure C. 1 After  $H + 60$  seconds the silicon and germanium filters were then sequenced at one-minute intervals.

The data shown in Figures 3.5 through 3.74 for Star Fish Prime have not been corrected for sensitivity changes due to temperature changes after  $H + 0$ .

On the system on Kettle II, channel 3 had its gain reduced by a factor of one hundred from the normal for times between  $H + 0$  and  $H + 3$  seconds. This was accomplished by lowering the detector bias during this period.

3.2.2 Filter Photometer (Section 2.2.3). Both 5.0-micron photometers on Kettle I recorded high-level signal

pulses from the X-ray pancake, of two or three seconds duration followed by a long decay lasting for over 60 seconds. A plot of apparent sky radiance versus time for the 5.0-micron photometers is given in Figure 3.75.

The single 2.7-micron photometer on Kettle I had a somewhat degraded response but did manage to record an initially sharp signal pulse and a rapidly decaying signal shown in Figure 3.76.

None of the data from Kettle II could be calibrated because of saturated electronics and a chopper motor which was not synchronized.

3.2.3 Image Dissector (Section 2.2.4). Sharp line structure is evident during the first four milliseconds (four spectral scans) after detonation from the Kettle II station. After this time the signal was lost in the system noise.

A spectrogram at  $H + 2$  msec from the Kettle II station is shown in Figure 3.77. The irradiance as presented is uncorrected for window transmission or pointing.

Examination of the pointing camera film indicates that the detonation point occurred 4.1 degrees left of the optical axis of the dissector. Referring to Figure 2.23, it can be seen that a small error in determination of the burst point azimuth can lead to a large error in the pointing correction

factor. It is suggested that the window transmission factor (0.9) be applied and that the resulting intensities be considered as the lower bound.

A time history of the decay of four prominent bands, also uncorrected for window transmission and pointing, is presented in Figure 3.78.

Although the dissector aboard Kettle I was extremely insensitive, spectra were observed for two milliseconds.

3.2.4 Dispersion Units (Section 2.2.5). On this shot the total irradiance at the aircraft was obtained in each of four broad spectral bands (0.29-0.40, 0.40-0.50, 0.50-0.75, and 0.75 - 1.0 micron ) for varying lengths of time. The peak intensities, however, were not obtained due to a combination of the rapid rise of the pulse plus capacitive coupling between the dispersion unit amplifiers. The coupling problem was excessive on this shot, but was compensated for on the subsequent shots.

The absolute intensity levels of the Kettle II data are uncertain at this time due to the large pointing correction which must be applied; hence, they are not presented.

Absolute irradiance data outside the aircraft and normal to the direction of the detonation point are presented

for the Kettle I station in Figures 3.79 through 3.82. The data have been corrected for window transmission. The pointing error was negligible.

The irradiance increase noted at  $H + 14$  msec (Figures 3.80 and 3.81) was seen at both aircraft stations. The increase noted at about  $H + 0.2$  seconds was seen only at Kettle I.

3.2.5 Filter Wheel Radiometer R4K1 (Section 2.2.5). The instrument aboard Kettle I obtained data in the following spectral bands: 1.565 - 1.62 microns, 2.15 - 2.21 microns, 2.64 - 2.71 microns, 2.63 - 2.73 microns, 1.63 - 1.92 microns, and 1.91 - 2.55 microns. Figures 3.83 through 3.88 present irradiance corrected for window transmission. The radiometer monitored the 85-km region under the detonation point on this shot.

The instrument aboard Kettle II malfunctioned during this shot.

3.2.6 PbS Radiometer (Section 2.2.7). Radiometer data are shown in Figure 3.89. A characteristic feature was the persistence of the radiation at late times. As would be expected, the flux at Maui (1490 kilometers from the detonation) is lower than that measured from the aircraft.

#### 3.2.7 Automatic Scanner Photometer (Section 2.2.8).

This instrument malfunctioned on this event. No data are available.

3.2.8 UV Spectrometer (Section 2.2.9). Data were recorded at both aircraft stations. Figure 3.90 shows a typical relative spectrogram (taken at H + 30 seconds) observed at the Kettle II station. Figure 3.91 shows the intensity decay of the structure at 3,470 Angstroms from H + 6 to H + 140 seconds, at which time it disappears into the system noise (Kettle II).

The data from the Kettle I station has not been reduced as yet.

3.2.9 Cameras (Section 2.2.11). A total of twenty-four photometric cameras operated for this event. The total photographic coverage inventory is listed on the next page.



<u>Number and Type of Camera</u>	<u>Exposures/Camera</u>	<u>Type Film</u>
<u>Kettle I</u>		
4 Nikon	36	Super Ansco
1 70 mm	100	Tri-X
1 All-sky	200	Tri-X
1 All-sky	200	Super Ansco
1 Streak	6 feet	Tri-X
<u>Kettle II</u>		
3 Nikon	36	Tri-X
1 Nikon	36	Super Ansco
1 70 mm	100	Super Ansco
1 All-sky	200	Tri-X
1 All-sky	200	Super Ansco
1 Streak	6 feet	Tri-X
<u>Maui</u>		
2 Nikon	36	Super Ansco
1 Robot	15	Tri-X
1 All-sky	100	Tri-X
2 Streak	6 feet	Tri-X
<u>Johnston Island</u>		
1 Nikon	36	Super Ansco
1 All-sky	63	Super Ansco
1 All-sky	63	Tri-X
1 Streak	6 feet	Tri-X
1 Streak	3 feet	Tri-X

All-sky views from the aircraft are shown in Figures 3.92 and 3.93. They show a green sky at early times which turned red in the later frames. The yellow streaks were aligned with the magnetic field. Figure 3.94 shows the view from Maui, and Figure 3.95 that from Johnston. A 70-mm frame, which shows the multiple streak structure is shown as Figure 3.96.

3.2.10 Photometer (Section 2.2.12). The usual strong auroral/airglow lines (3,914, 5,577, and 6,300 Angstroms) were observed to be extremely bright and persistent. At early times the OI green line was the dominant feature. A typical flux versus time plot, for the 6,300-Angstrom OI line, is shown in Figure 3.97. There was considerably weaker emission at the reference wavelengths (4,410, 5,100 and 6,100 Angstroms) and through the reference continuum neutral density 2 filter.

Data for the near infrared wavelength band is shown in Figure 3.98. The fluxes were still a factor ten above background at 15 minutes and decreased very slowly.

### 3.3 CHECK MATE

3.3.1 Spatial Radiometer (Section 2.2.2). Data from Check Mate are presented in Figures 3.99 through Figure 3.143. During Check Mate, channel 3 of the system on Kettle I and channel 6 of the system on Kettle II were inoperative due to electronic malfunctions. On both systems, detectors 10, 11, 12 and 13 were disconnected from their respective channels. These channels were then connected to form the low-sensitivity components of channels 3, 5, 7 and 21 as shown in Figure C.29.

Channel 21 of the system on Kettle II had its sensitivity reduced a factor of 100 from normal during the period  $H + 0$  to  $H + 3$  seconds.

Both systems were operated such that from  $H + 0$  to  $H + 120$  seconds the silicon filter was in place. After  $H + 120$  seconds the germanium and silicon filters were sequenced at 60-second intervals.

3.3.2 Filter Photometer (Section 2.2.3). All four of the 5.0-micron photometers obtained useful data for early times, as can be seen from the sky radiance plots in Figure 3.144. Cloud backgrounds obscured the low-level signals from being recorded by telescopes Nos. 3 and 4 on board the Kettle II aircraft, while cryostat freeze-ups made

telescopes Nos. 5 and 6 insensitive, but fortunately not until after the signals from the event had been recorded. A right roll of the aircraft was responsible for the increase in the background signal at about  $H + 125$  seconds on telescopes Nos. 3 and 4. During this roll they were directed at the lower warm atmosphere.

The 2.7-micron photometers were just able to record some signal pulses which rapidly decayed to background levels, as shown in Figure 3.145.

The radiation from the X-ray pancake was quite low, as would be expected from the low bomb yield. Those telescopes (Nos. 3 and 5) which were pointed at the burst, in general, gave somewhat higher sky radiance data.

3.3.3 Image Dissector (Section 2.2.4). Several emission bands superimposed upon a continuum were observed at the Kettle I station until approximately  $H + 35$  msec. The continuum was observed until the signal decreased into the system noise at  $H + 70$  msec. Spectrograms taken at  $H + 12$ ,  $H + 17$ ,  $H + 26$ , and  $H + 50$  msec are presented as Figures 3.146 through 3.149. A time history of the intensity in the 3,914- and 4,278-Angstrom bands is presented as Figure 3.150. The intensity increase noted in the vicinity of  $H + 9$  msec was also observed with the dispersion units (see Section 3.3.4).

The absolute intensities presented in Figure 3.146 through 3.150 have not been corrected for window transmission or pointing error (see Table E.2).

Data were acquired at the Kettle II station but are unreduced as yet.

3.3.4 Dispersion Units(Section 2.2.5). The total irradiance of the prompt optical-IR pulse was obtained in each of four broad spectral bands for about 30 msec after burst at the Kettle I station.

The pulse appeared to rise linearly and to peak at approximately  $H + 70 \pm 10 \mu \text{ sec}$ . There are not enough data available to determine if the time-to-peak was spectrally dependent.

Plots of irradiance versus time, outside of the aircraft and normal to the detonation point, are presented in Figures 3.151 through 3.154.

An estimate of the peak intensity obtained with unit NIR-9 is presented in Figure 3.154. The data from this unit had a low signal-to-noise ratio; hence, only the peak value is presented for comparison with NIR-2. The peak value from NIR-2 must be considered a lower bound, because its voltage level was well into the non-linear operating range of the tape recorder. A non-linear calibration has been unsuccessfully attempted.

A second peak was observed in each spectral region at approximately 8 msec. This peak was also seen by the image dissector (Section 3.3.3) on Kettle I and by two dispersion units on Kettle II.

Data were recorded in all spectral regions on Kettle II, but the peak intensity values were lost due to amplifier coupling problems similar to those encountered on Star Fish Prime. The units on this aircraft did not view the detonation point, due to aircraft misorientation at burst time. Data from Kettle II are not presented.

#### 3.3.5 Filter Wheel Radiometer R4K1 (Section 2.2.6).

The instrument aboard Kettle I obtained data for about 100 seconds following burst in the following bands: 1.55 - 1.615, 1.62 - 1.93, 2.15 - 2.21, 2.645 - 2.72, and 1.87 - 2.56 microns. Figures 3.155 through 3.159 present irradiance at the aircraft corrected for window transmission.

On this event the radiometer could view only the low aurora, since it could not track higher than 43 degrees.

#### 3.3.6 PbS Radiometer (Section 2.2.7). The

radiometers (Figure 3.160) showed signals one hundred times background at H + 30 seconds and ten times background at H + 100 seconds. The decay was more rapid in the instrument

aboard Kettle II, which had the detonation center just outside its field of view. No radiometer reading was registered at Maui (which is not surprising in light of the short duration of the main thermal pulse from this small detonation and the slow response of the instrument ).

#### 3.3.7 Automatic Scanner Photometer (Section 2.2.8).

This instrument, aboard Kettle I, obtained data for approximately 2000 seconds after burst in the following spectral bands: 0.373 - 0.396, 0.420 - 0.456, 0.358 - 0.558, 0.521 - 0.567, and 0.590 - 0.613 micron.

Contours of isobrightness, in the above-listed bands are presented in Figures 3.161 through 3.252. Scans of normal sky background just prior to H - 0 are also included for each of the spectral bands.

The elevation angle is referenced to the local horizontal at the location of the aircraft. The actual bearing has not been incorporated into any of the figures. The scanner bearing can be converted to actual bearing if needed (see Section 2.2.8).

The heavy unbroken lines denote the major contours, spaced at uniform radiance intervals, and the light unbroken lines indicate additional contours that are necessary to adequately describe the radiance pattern. A dashed line indicates

the probable position of a contour where there are no actual data to definitely locate it, such as in regions immediately outside the scan range of the instrument. The marks placed along the inside edge of a closed contour, indicate that the area within the contour has a radiance lower than that of the contour.

The time at which the scanner is mid-way through the scan (40-degree elevation and 0-degree scanner bearing) is indicated on each map.

3.3.8 UV Spectrometer (Section 2.2.9). The instrument aboard Kettle I acquired data in the spectral region 2,800 to 3,800 Angstroms for approximately 35 seconds after detonation. Radiating bands are identifiable at 3,160, 3,365, 3,475, and 3,560 Angstroms. The accuracy in wavelength identification is  $\pm 10$  Angstroms.

A typical spectrogram, taken at H + 8 seconds is presented in Figure 3.253. This spectrum is uncorrected for phototube response versus wavelength. The decay of the 3,560-Angstrom band is presented in Figure 3.254. Since emission in this band was also present on the subsequent shots, the decay histories are all presented together.

Data were acquired at the Kettle II station but are unreduced as yet.



3.3.9 Cameras (Section 2.2.11). A total of 22 photometric cameras acquired data on Shot Check Mate. The total inventory is as follows:

<u>Number and Type of Camera</u>	<u>Exposures/Camera</u>	<u>Type Film</u>
<u>Kettle I</u>		
2 Nikon 35 mm	36	Tri-X
2 Nikon 35 mm	36	Tri-X
1 70 mm	100	Super Ansco
1 All-Sky 16 mm	300	Super Ansco
1 Streak 35 mm	6 feet	Tri-X
<u>Kettle II</u>		
2 Nikon 35 mm	36	Tri-X
1 Nikon 35 mm	36	Super Ansco
1 70 mm	100	Tri-X
1 Streak 35 mm	6 feet	Tri-X
<u>Maui</u>		
1 Nikon 35 mm	36	Super Ansco
1 Robot 35 mm	36	Tri-X
1 All-Sky 16 mm	500	Tri-X
2 Streak 35 mm	6 feet	Tri-X
<u>Johnston Island</u>		
1 Nikon 35 mm	36	Super Ansco
1 All-Sky 16 mm	300	Tri-X
1 All-Sky 16 mm	300	Super Ansco
1 Streak 35 mm	3 feet	Tri-X
1 Streak 35 mm	6 feet	Tri-X

The growth of the late fireball is shown in a series of sequential 70-mm photographs (Figures 3.255 to 3.261) and is summarized in the all-sky frames shown in Figure 3.262. The upper cameras with Tri-X film show a just-discernible increase in sky brightness near  $H + 500$  sec.

3.3.10 Photometer (Section 2.2.12). Data for two narrow bands (containing 4,278 and 5,577 Angstroms) and two wide bands (total-visible and near-infrared) are shown in Figures 3.263, 3.264, 3.265, and 3.266. The flux received at Maui was highly variable, since there was a cloud cover. The infrared photometer signal at Maui was extremely strong at  $H + 0$  but lasted only 10 seconds. The second maximum at  $H + 600$  seconds was observed only in the 5,577- and 6,300-Angstrom bands. The signal decreased to a flat minimum near  $H + 400$  seconds, increased to a second maximum at  $H + 600$  seconds, and decreased slowly thereafter. A vestigial second maximum showed in the Johnston total-visible data.

The near-infrared signals remained above background for about 600 seconds. In the visible, the increase over background persisted at least twice as long.

3.3.11 Photomultiplier (Section 2.2.14). The units on both aircraft obtained data on this shot. The S-11

(ultraviolet) tube in Kettle I recorded a peak intensity at approximately  $H + 40 \mu \text{ sec}$ . The leading edge of this pulse was characterized by two maxima and one minimum, the maxima being observed at approximately  $H + 4$  and  $H + 15 \mu \text{ sec}$ . The pulse acquired by the S-1 tube on board Kettle II indicated a smooth rise to a maximum at approximately  $H + 44 \mu \text{ sec}$ .

The oscilloscope triggering levels were set above the zero signal levels in order to guarantee that the oscilloscope would not be triggered by random noise near  $H - 0$ . The slope of the data acquired from both stations was fairly shallow, indicating that the apparent times to peak can be considered as lower bounds only.

### 3.4 BLUE GILL TRIPLE PRIME

3.4.1 Spatial Radiometer (Section 2.2.2). Data from Blue Gill Triple Prime are presented in Figures 3.267 through 3.334.

On Blue Gill Triple Prime detectors 10, 11, 12, and 13 were disconnected from their channels on both systems. The tape record channels and electronics from these detectors were utilized to extend the dynamic range of channels 3, 5, 7, and 21.

All channels functioned properly on this shot. Data were recorded for 90 minutes on each aircraft system. On the system on Kettle I, the silicon filter was in position from H + 0 to H + 1,630 seconds. At that time the silicon and germanium filters began sequencing at approximately one-minute intervals. Data were lost between H + 2000 seconds and H + 2,200 seconds on the system on Kettle I due to a malfunction in the filter-sequencing system.

On the system on Kettle II, the silicon filter was in position from H + 0 to H + 70 seconds. After this time the germanium and silicon filters sequenced at one-minute intervals.

3.4.2 Filter Photometer (Section 2.2.3). All photometers were pointed at the detonation point for this event. The 5.0-micron signal from telescopes Nos. 3 and 4 varied widely with time, as is evident in Figure 3.335. This can be traced to the aircraft orientation. The large intense fireball appeared to leave the field of view after about 60 seconds at which time the aircraft went first into a right roll, pointing the telescopes toward the warm atmosphere, and then into a left roll, which brought the fireball back into the field of view again. This procedure was repeated beginning at about H + 175 seconds, but by this time, the fireball was of much lower intensity.

The 2.7-micron photometers in telescopes Nos. 3 and 4 also recorded the initial phases of the above pattern, as shown in Figure 3.336, but at this wavelength, of course, no significant atmospheric signals were seen when they were pointed at sub-horizontal fields of view.

No 5.0-micron data from telescopes Nos. 5 and 6 on the Kettle I aircraft were recorded, due to a gas pressure failure, and no in flight calibration of the 2.7-micron photometers was made, although good data were obtained.

3.4.3 Image Dissector (Section 2.2.4). Spectral data were obtained at the Kettle I station commencing at approximately  $H + 1,300$  msec when the signal levels decayed out of saturation. Three bands centered at 3,590, 3,914, and 4,226 Angstroms are evidently superimposed on a strong continuum.

Spectrograms taken at  $H + 1,602$  and  $H + 2,250$  msec are presented as Figures 3.337 and 3.338. A time history of the above-mentioned bands is presented in Figure 3.339. The absolute intensities presented in Figures 3.337 through 3.339 have not been corrected for window transmission or pointing (see Table E.2).

Data were acquired at the Kettle II station but are unreduced as yet.

3.4.4 Dispersion Units (Section 2.2.5). The total irradiance of the prompt optical-IR pulse was obtained in each of four broad spectral bands for about 5 seconds at both aircraft stations.

The peak intensity occurred at approximately  $H + 800 \pm 100 \mu\text{sec}$ ; absolute peak irradiance levels were obtained in the 0.29 - 0.40, 0.40 - 0.50 and 0.50 - 0.75 micron regions. No data were obtained in the 0.75 - 1.0 micron region before  $H + 3 \text{ msec}$ , because of the coupling problem previously discussed (Section 3.2.4). The leading edge of the pulse was acquired by only one unit (NUV -8) due to coupling. Units in two other regions (BLU, and RED) however, were decoupled before the time of peak irradiance. The irradiance increased rapidly in the first 100 to 200  $\mu\text{sec}$ , then leveled off such that the rate of change in the time period  $H + 500 \mu\text{sec}$  to 2 msec was extremely small. In the NUV region the pulse rose to 90 percent of its peak value in  $200 \pm 20 \mu\text{sec}$ .

A sharp decay was noted in all spectral regions in the vicinity of  $H + 50 \text{ msec}$ .

Plots of irradiance versus time, at the outside of the aircraft, normal to the detonation point are presented in

Figures 3.340 through 3.343. Data from both aircraft are presented on the same graph because of the similarity in slant ranges and pointing achieved on this shot.

#### 3.4.5 Filter Wheel Radiometer R4K1 (Section 2.2.6).

Data were obtained for about 40 minutes at the Kettle I station in the following bands: 1.55 - 1.615, 1.62 - 1.93, 2.15 - 2.21, 2.645 - 2.72, 2.65 - 2.79, and 1.87 - 2.56 microns. Figures 3.344 through 3.351 present irradiance at the aircraft corrected for window transmission.

On this shot the radiometer tracked the fireball at early times and the glowing toroid (that it evolved into) at later times.

3.4.6 PbS Radiometer (Section 2.2.7). The radiometers, which were pointed 19 to 27 degrees away from the detonation (25 - 30 km was the closest approach of the detonation from the line-of-sight), showed highly variable readings at early times (Figure 3.352). The signals were a factor of ten above background for 1,500 to 2,500 seconds (Figure 3.352), decaying with a characteristic half-life of about 400 seconds. The Maui station, for which the detonation is three degrees below the horizon, showed only a weak, short-lived pulse.

3.4.7 Automatic Scanner Photometer (Section 2.2.8).

This instrument malfunctioned. No data are available on this shot.

3.4.8 UV Spectrometer (Section 2.2.9). The

instrument aboard Kettle I acquired data until approximately H + 30 minutes, in the spectral region from 2,800 to 3,800 Angstroms. Strong radiating bands are identifiable, centered at 3,160, 3,365, and 3,555 Angstroms.

A typical spectrogram taken at H + 176 seconds is presented as Figure 3.353. This spectrum is uncorrected for phototube response versus wavelength. The decay of the band centered at 3,555 Angstroms is presented in Figure 3.254.

3.4.9 Cameras (Section 2.2.11). A total of 24

photometric cameras acquired data on this event. The total photographic coverage inventory is presented on the next page.



<u>Number and Type of Camera</u>	<u>Exposures/Camera</u>	<u>Type Film</u>
<u>Kettle I</u>		
2 Nikon 35 mm	36	Tri-X
2 Nikon 35 mm	36	Super Ansco
1 70 mm	100	Tri-X
1 All-Sky 16 mm	300	Super Ansco
1 All-Sky 16 mm	300	Super Ansco
1 Streak 35 mm	6 feet	Tri-X
<u>Kettle II</u>		
2 Nikon 35 mm	36	Tri-X
2 Nikon 35 mm	36	Super Ansco
1 70 mm	100	Super Ansco
1 All-Sky 16 mm	300	Tri-X
1 All-Sky 16 mm	300	Super Ansco
1 Streak 35 mm	6 feet	Tri-X
<u>Maui</u>		
1 Nikon 35 mm	36	Super Ansco
1 Robot 35 mm	36	Tri-X
1 All-Sky 16 mm	500	Tri-X
2 Streak 35 mm	6 feet	Tri-X
<u>Johnston Island</u>		
1 Nikon 35 mm	36	Super Ansco
1 Streak 35 mm	3 feet	Tri-X
1 Streak 35 mm	6 feet	Tri-X

The fireball was extremely bright, and many of the photographs were overexposed during the first 50 seconds. Figure 3.354 shows the familiar blue-white aurora extending out from the toroidal fireball along the field lines. A faint external aurora was still detectable at H + 274 seconds (Figure 3.355). The photograph at 567 to 574 seconds is shown in Figure 3.356. All-sky views from the two aircraft, showing the evolution of the fireball and the aurora, are shown in Figure 3.357.

The Maui photographs showed a bright sky in the first few frames but no discernible feature rose above the horizon.

3.4.10 Photometer (Section 2.2.12). The fluxes before H + 100 seconds were very high with most channels off-scale.

In the infrared region, the photometer signals were still ten times background at H + 2,000 seconds (Figure 3.358). They decayed exponentially with a half-life of about 400 seconds. The flux at Maui was detectable to H + 30 seconds. At this time the signals at the nearer stations were at least  $10^4$  times background.

In the visible region, there was evidence of white emission (although further analysis of all the channels is necessary to confirm this point). The broadband visible

channel data for the two aircraft are shown in Figure 3.359; the signals were still thirty times background at  $H + 2,500$  seconds and showed characteristic half lives of 400 and 365 seconds. The flux at Maui, which was detectable above background for about 30 seconds, also appeared white.

3.4.11 Photomultiplier (Section 2.2.14). No Photomultiplier data were obtained on this shot due to malfunctions. (Chapter 3 is continued in Volume 3.)

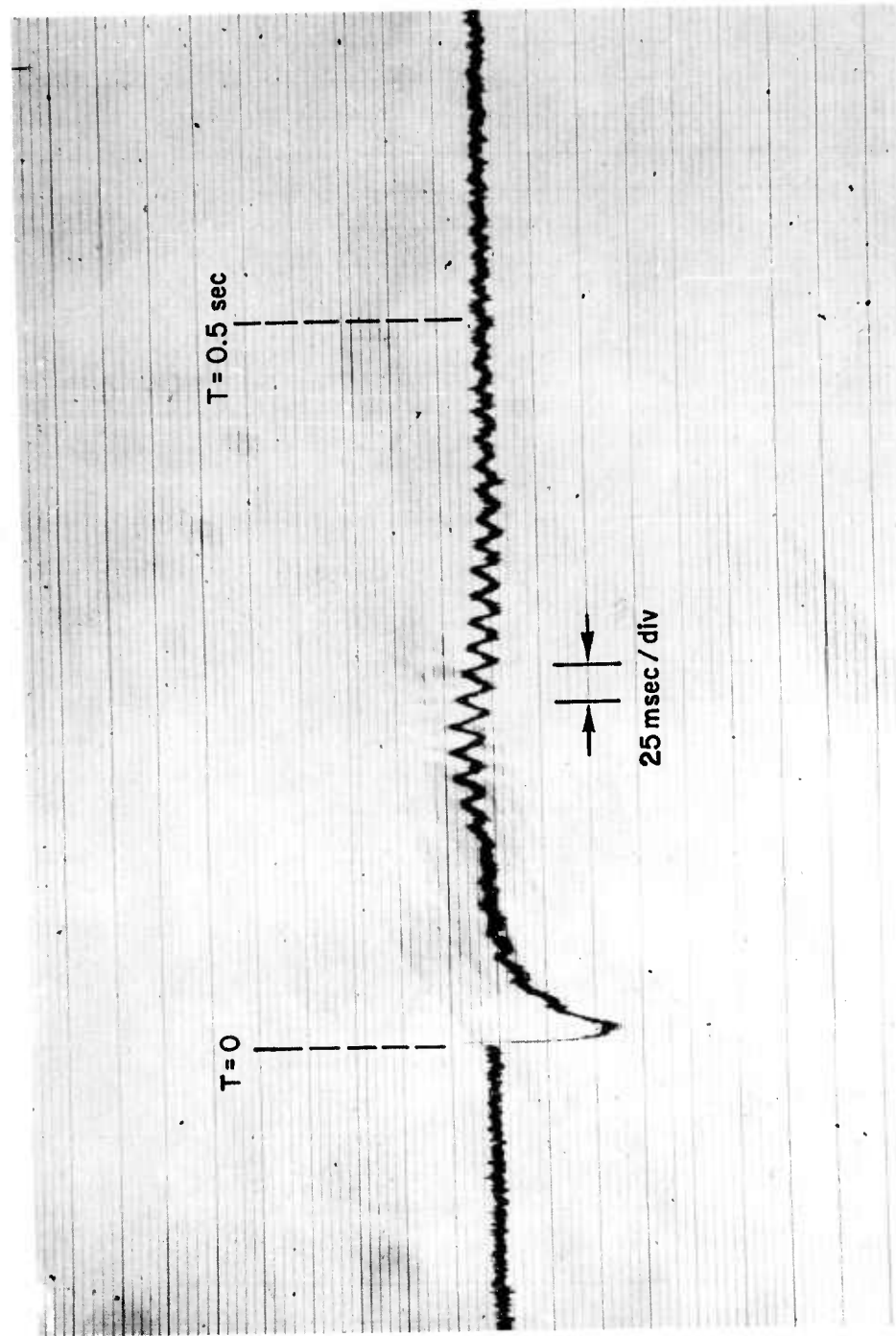


Figure 3.1 Example of raw data on Channel 3, Kettle I, Star Fish Prime.

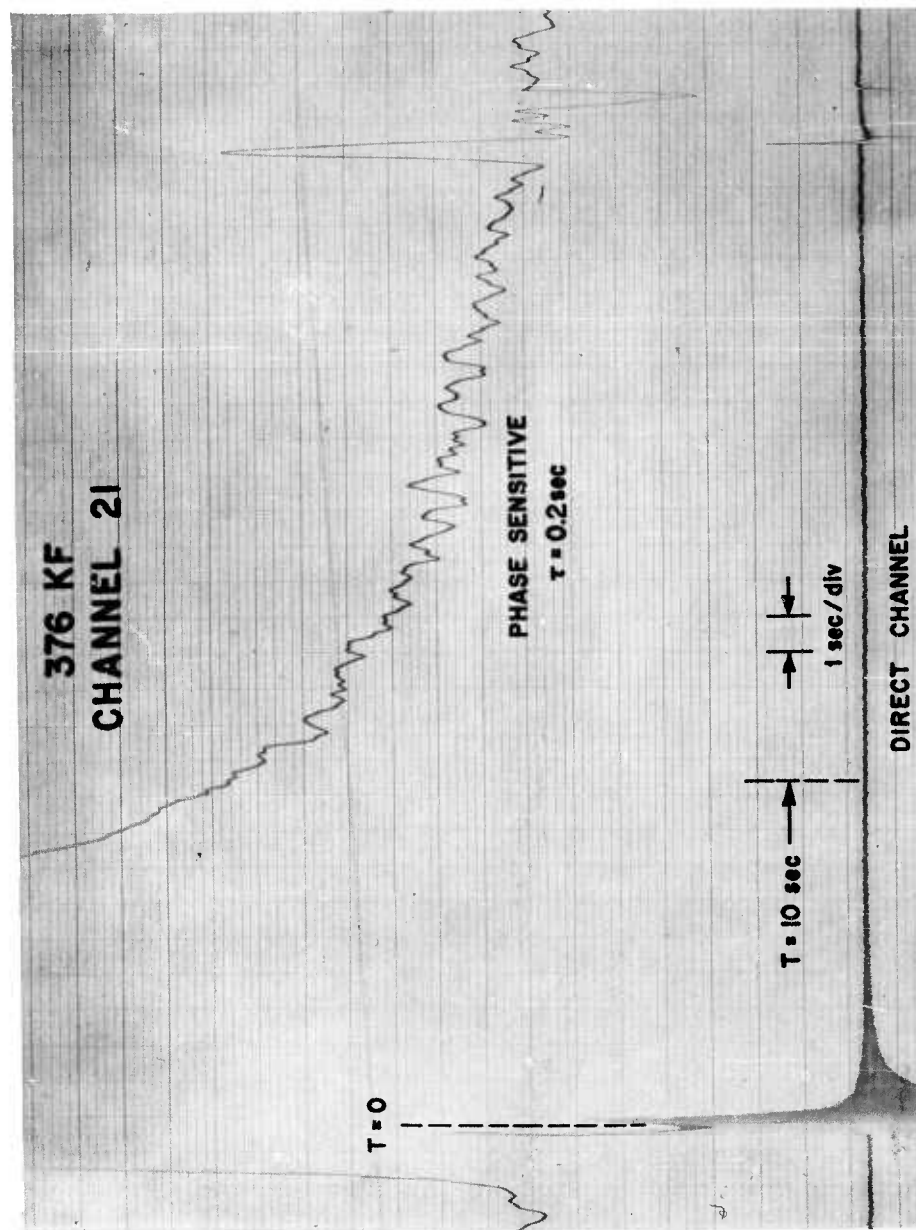


Figure 3.2 Comparison of phase-sensitive and direct playback data on Channel 21, Kettle II, King Fish.

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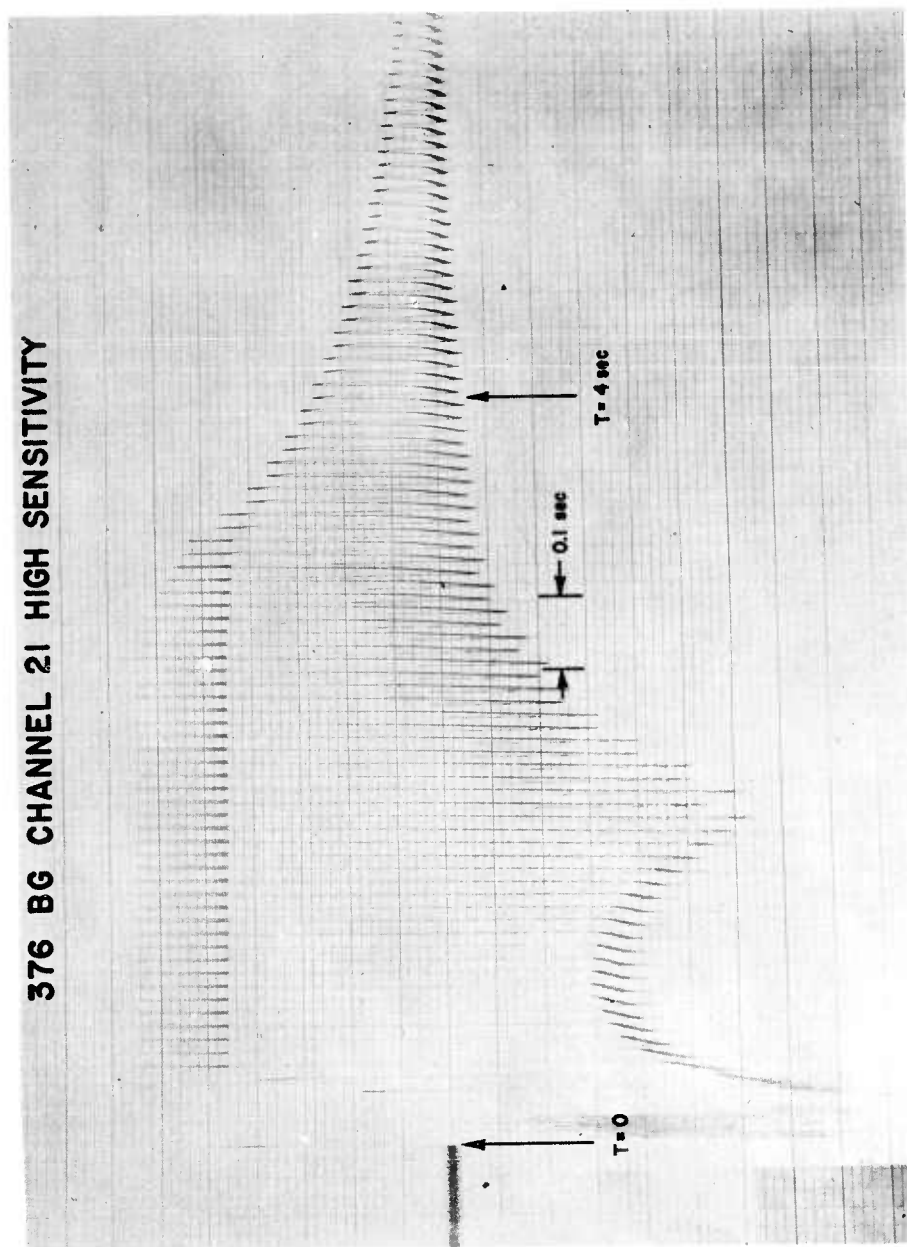


Figure 3.3 Example of low-sensitivity branch of Channel 21, Kettle II, King Fish.

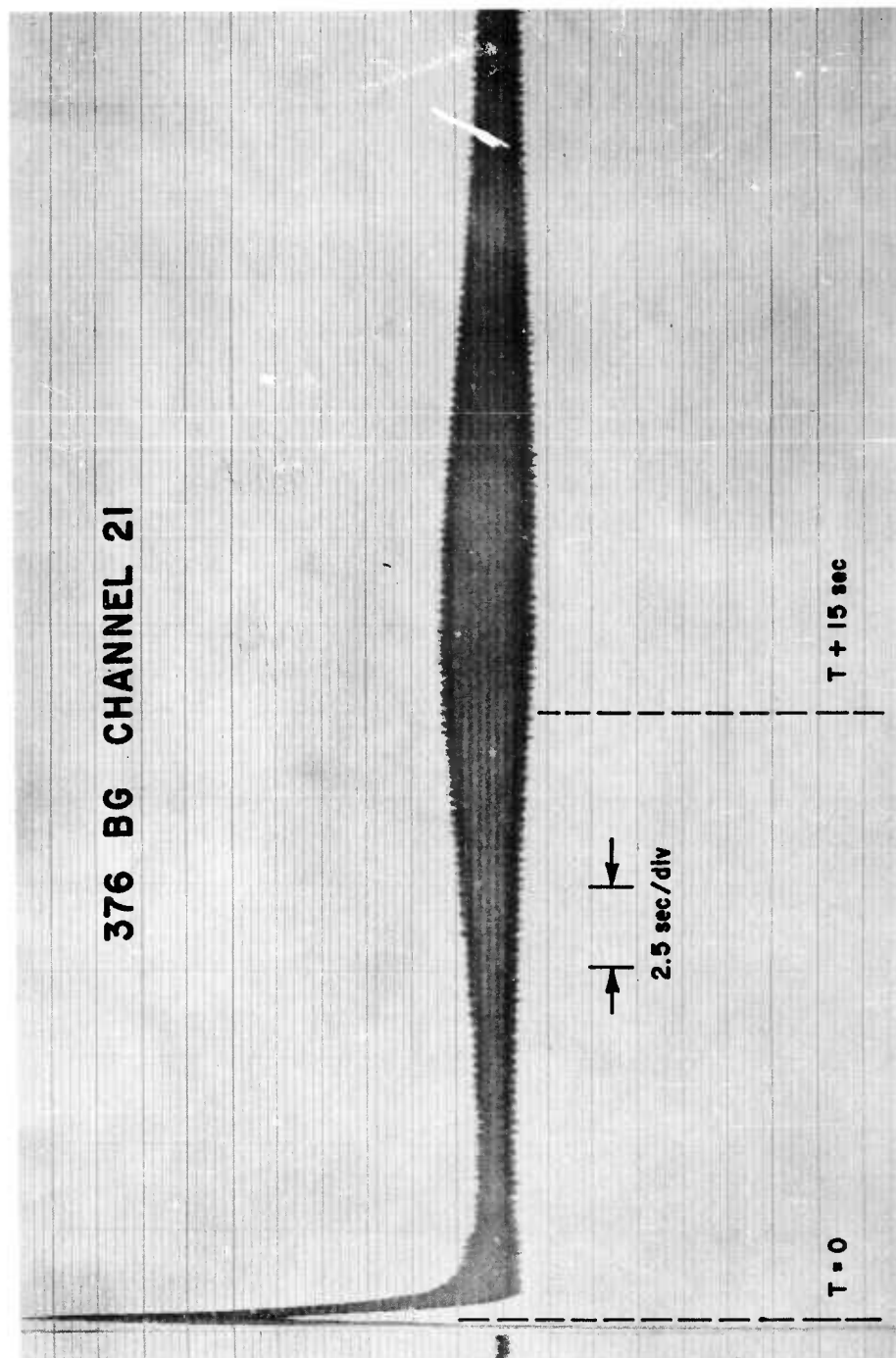


Figure 3.4 Raw data showing second peak at about H + 15 seconds, Kettle II, Blue Gill Triple Prime.

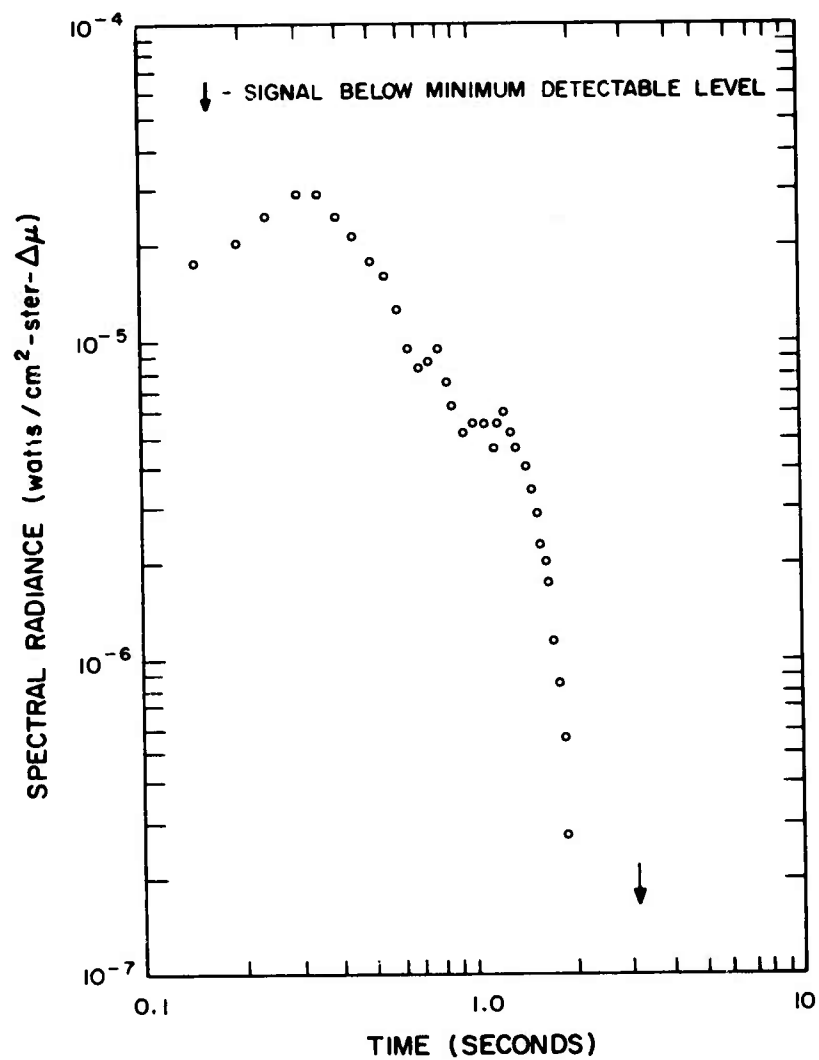


Figure 3.5 Spectral radiance, Kettle I, Star Fish Prime, Channel 1.



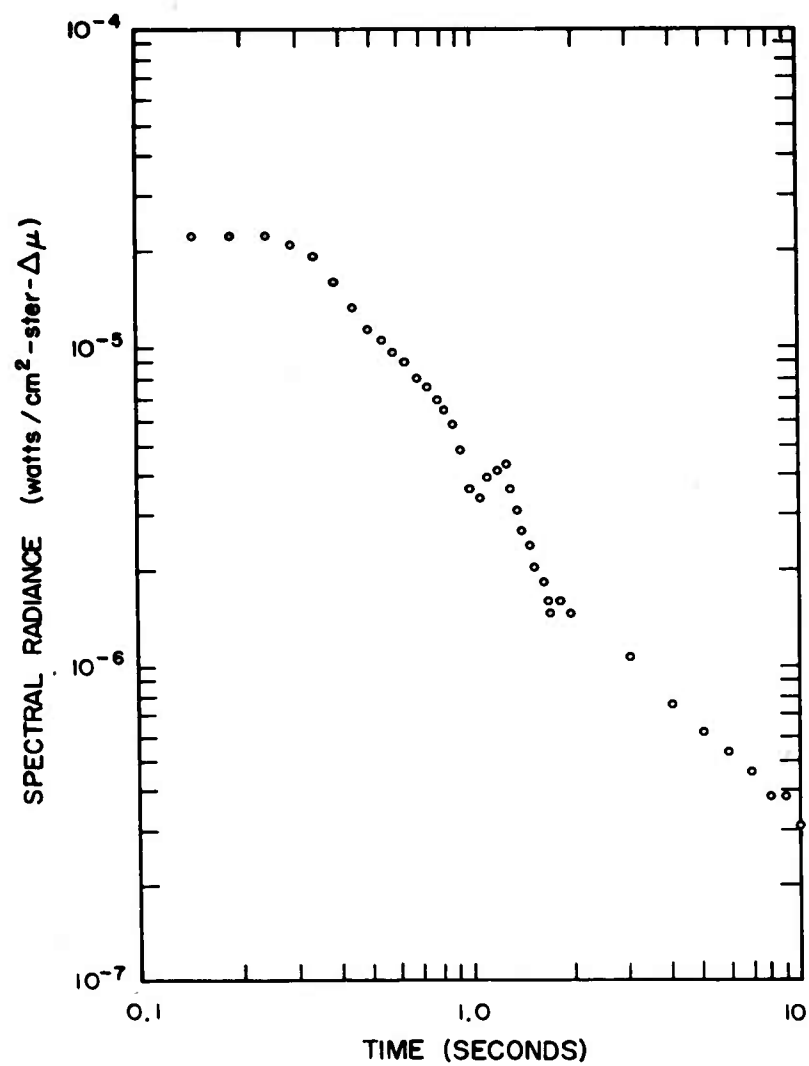


Figure 3.6 Spectral radiance, Kettle I, Star Fish Prime, Channel 2, early time.



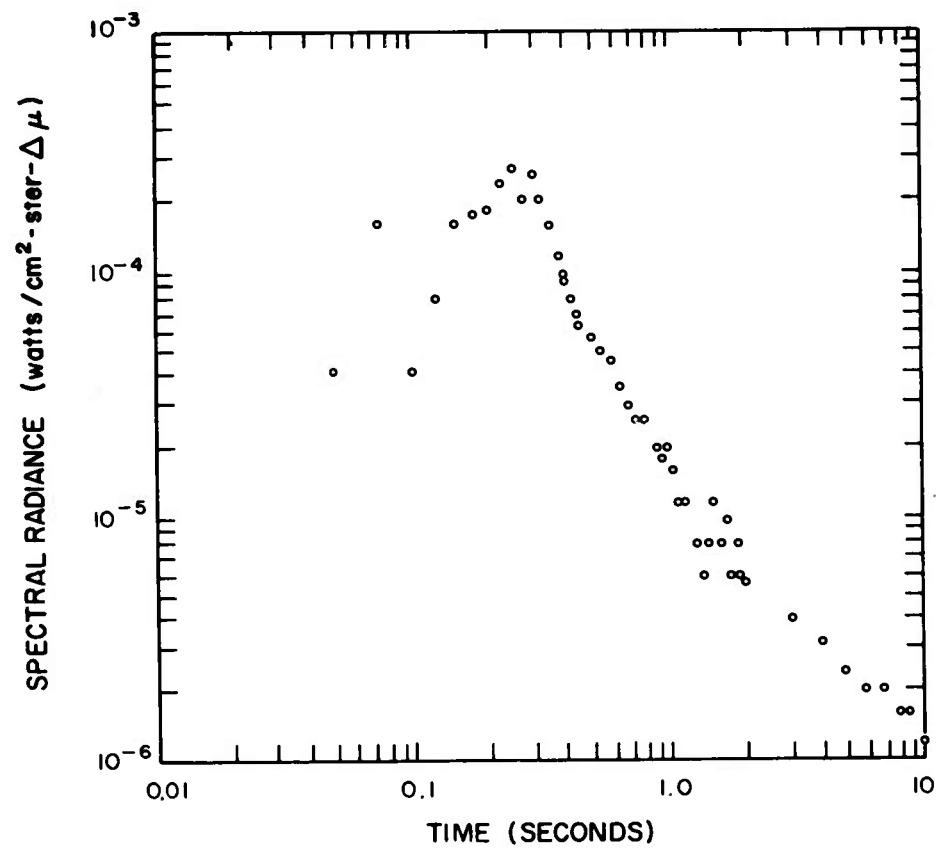


Figure 3.8 Spectral radiance, Kettle I, Star Fish Prime, Channel 3, early time.

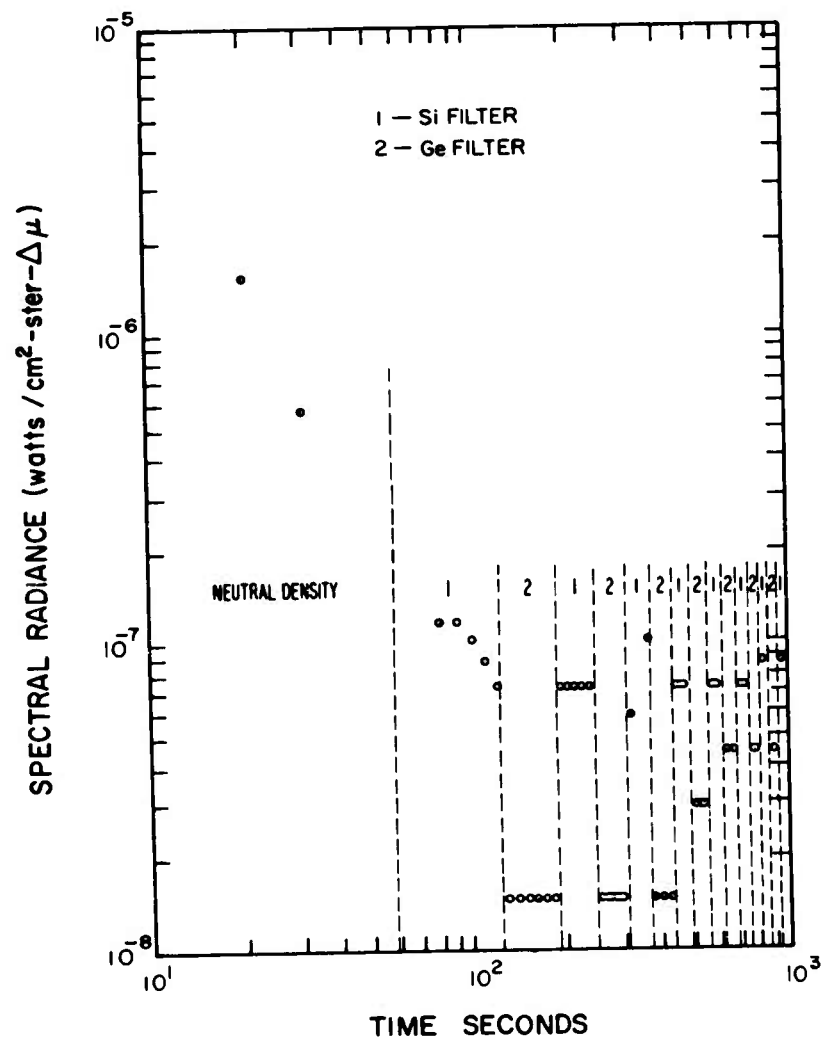


Figure 3.9 Spectral radiance, Kettle I, Star Fish Prime, Channel 3, late time.

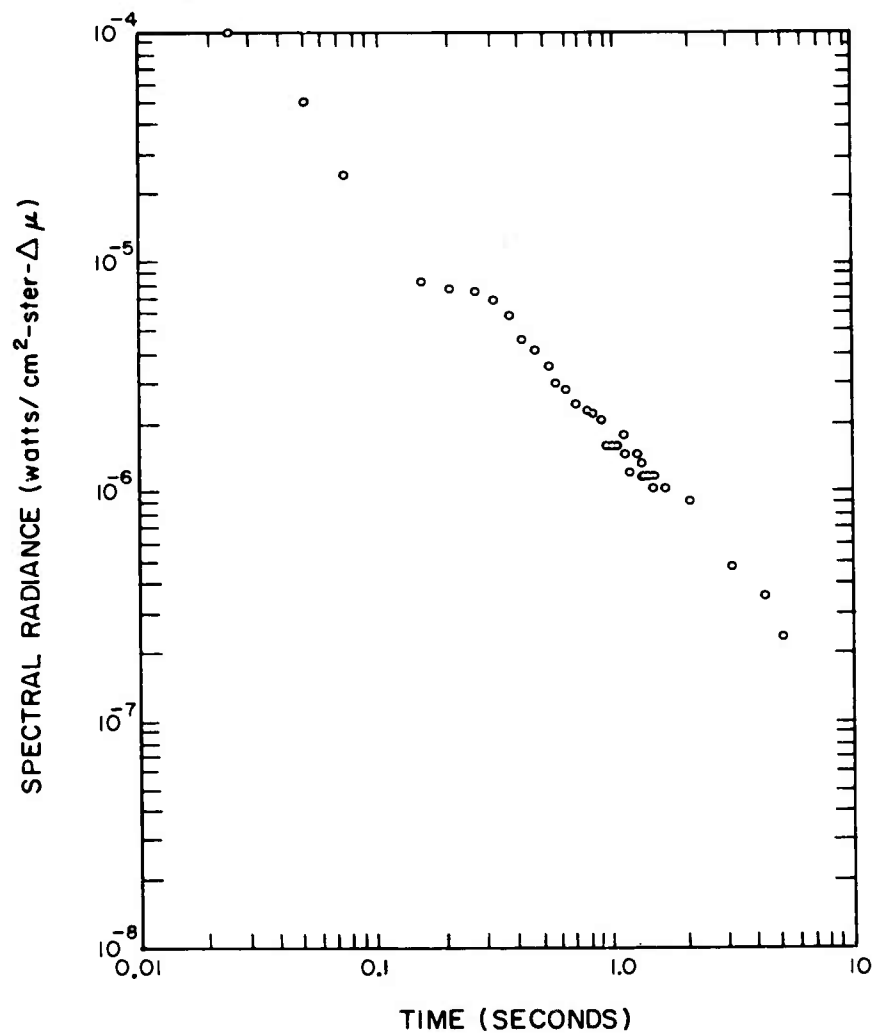


Figure 3.10 Spectral radiance, Kettle I, Star Fish Prime, Channel 4, early time.

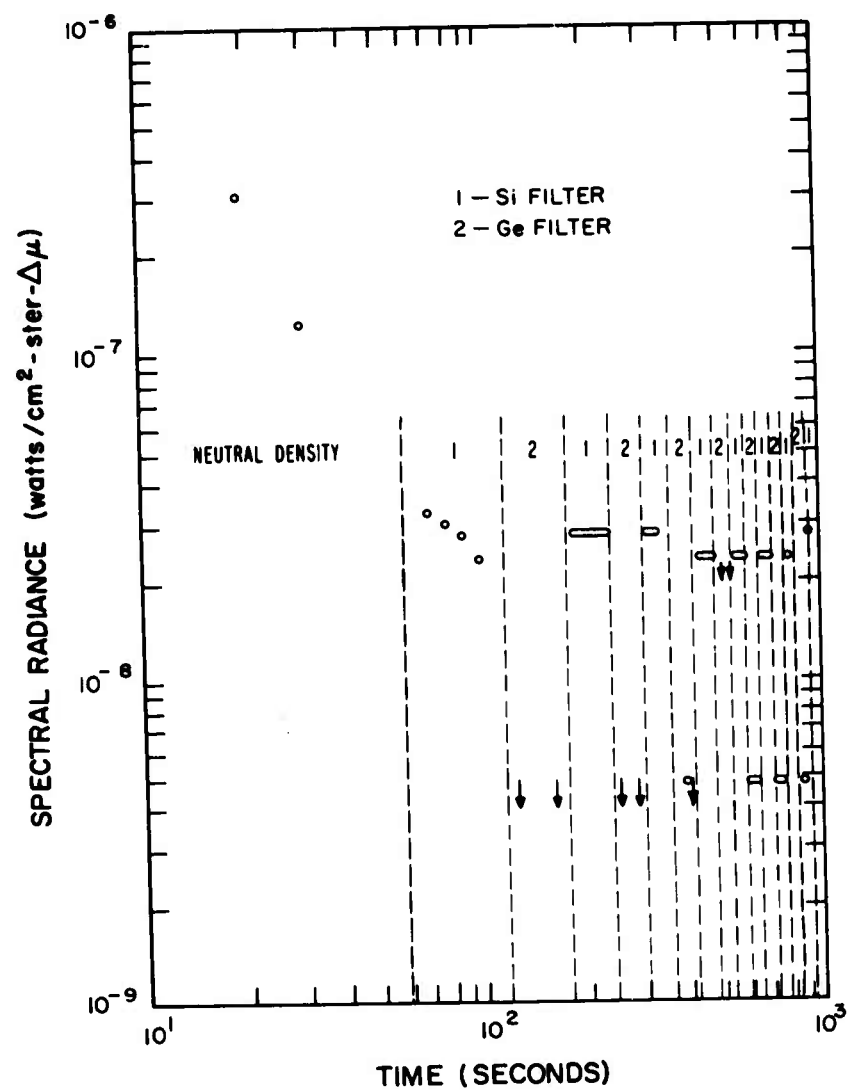


Figure 3.11 Spectral radiance, Kettle I, Star Fish Prime, Channel 4, late time.

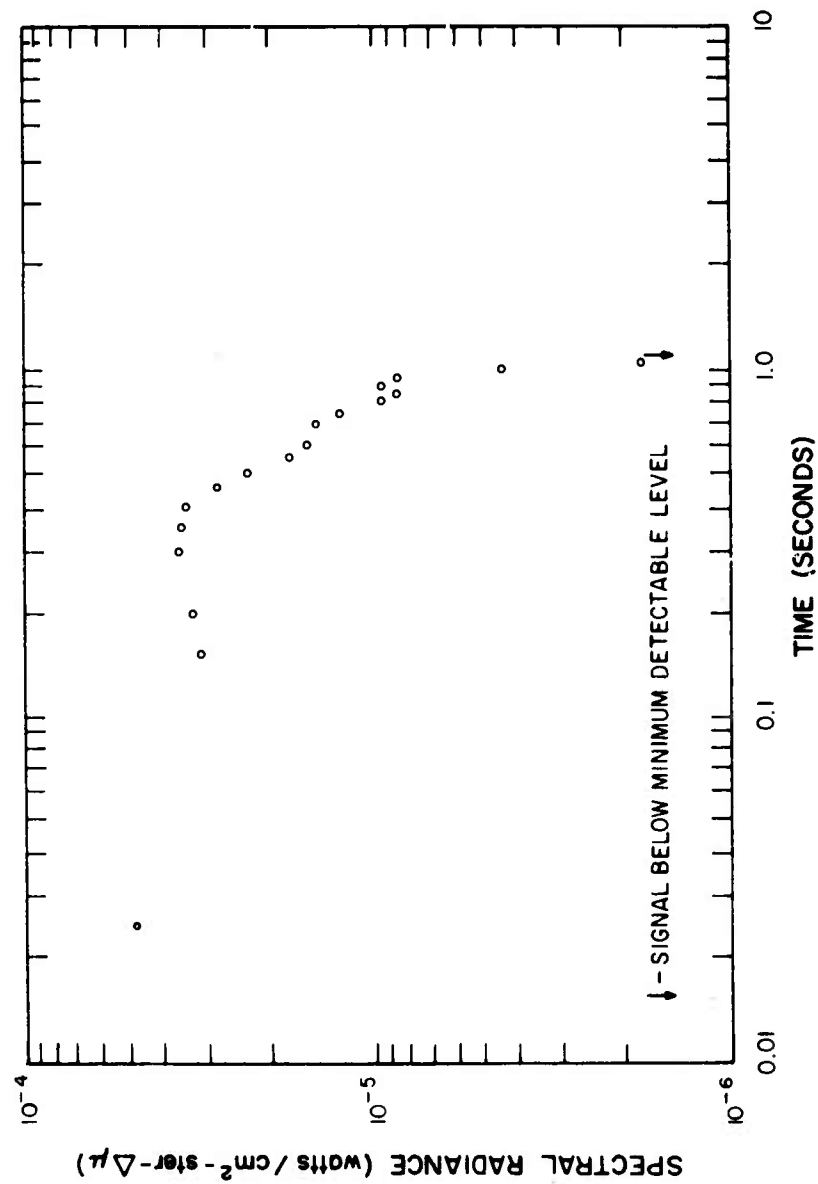


Figure 3.12 Spectral radiance, Kettle I, Star Fish Prime, Channel 5, early time.

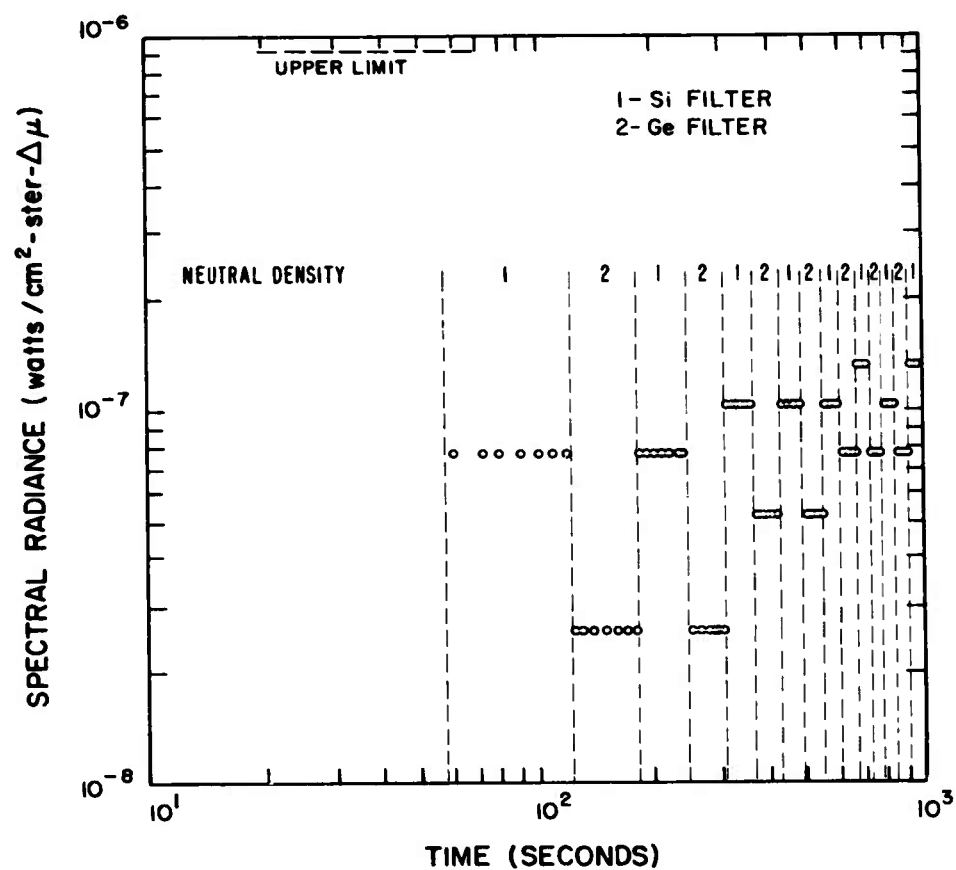


Figure 3.13 Spectral radiance, Kettle I, Star Fish Prime, Channel 5, late time.



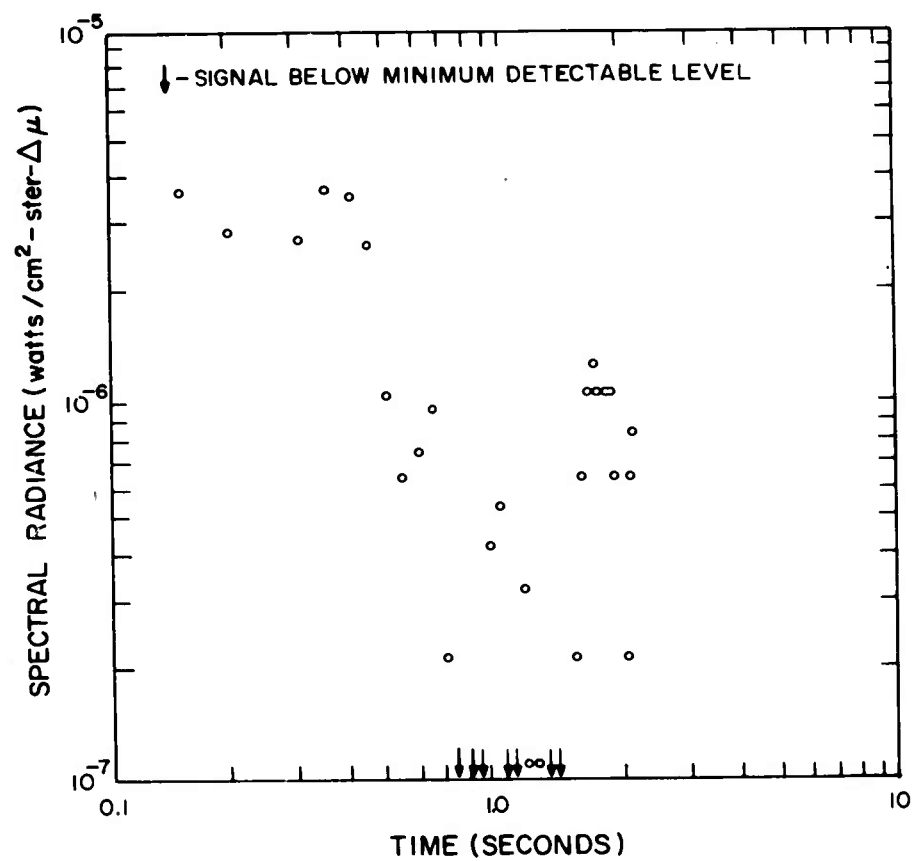


Figure 3.14 Spectral radiance, Kettle I, Star Fish Prime, Channel 6, early time.

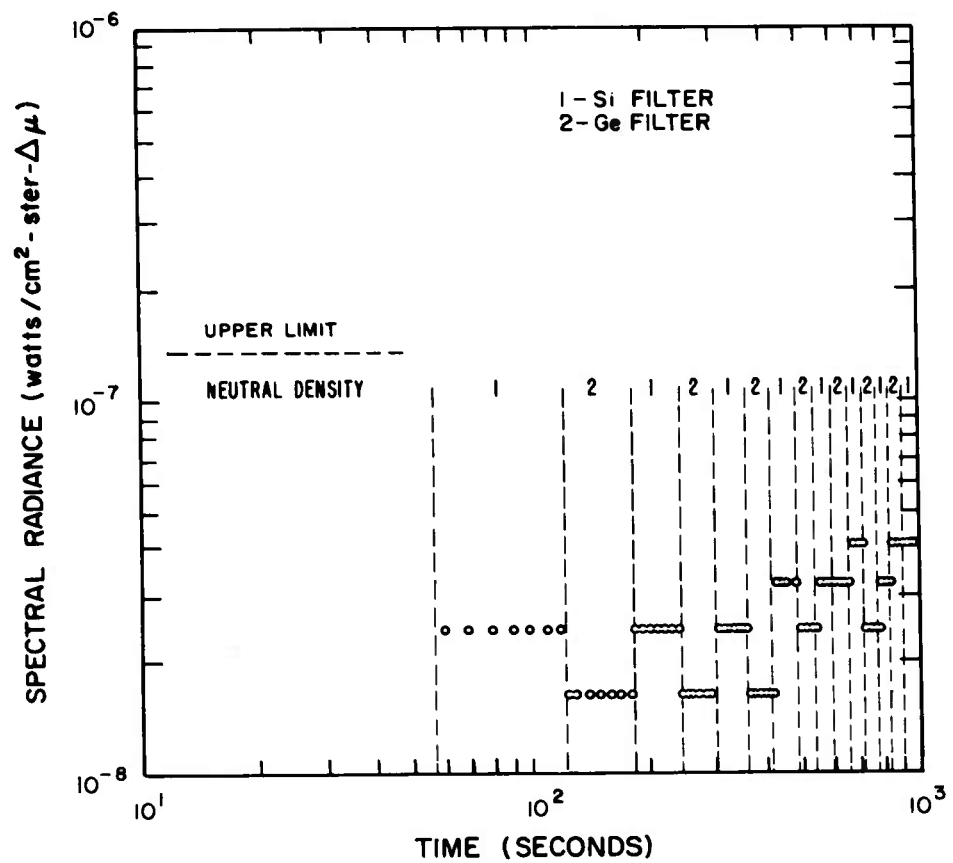


Figure 3.15 Spectral radiance, Kettle I, Star Fish Prime, Channel 6, late time.

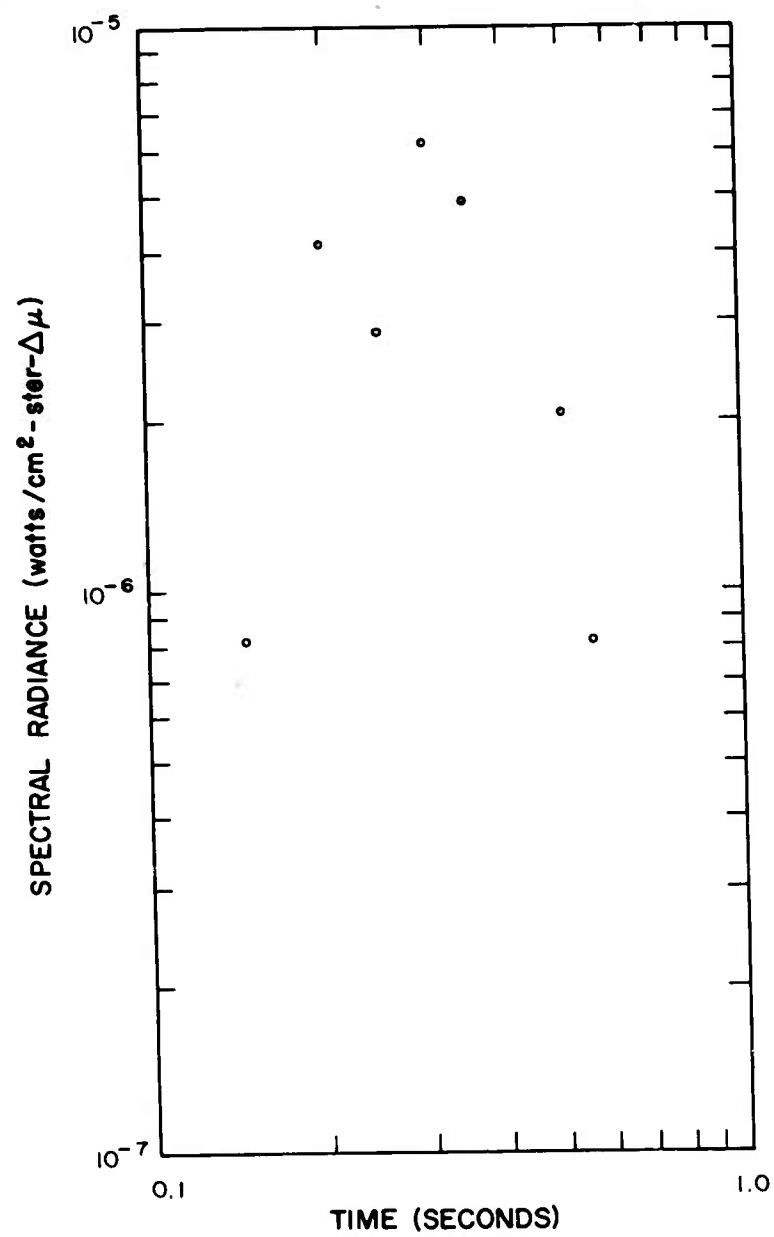


Figure 3.16 Spectral radiance, Kettle I, Star Fish Prime, Channel 7, early time.

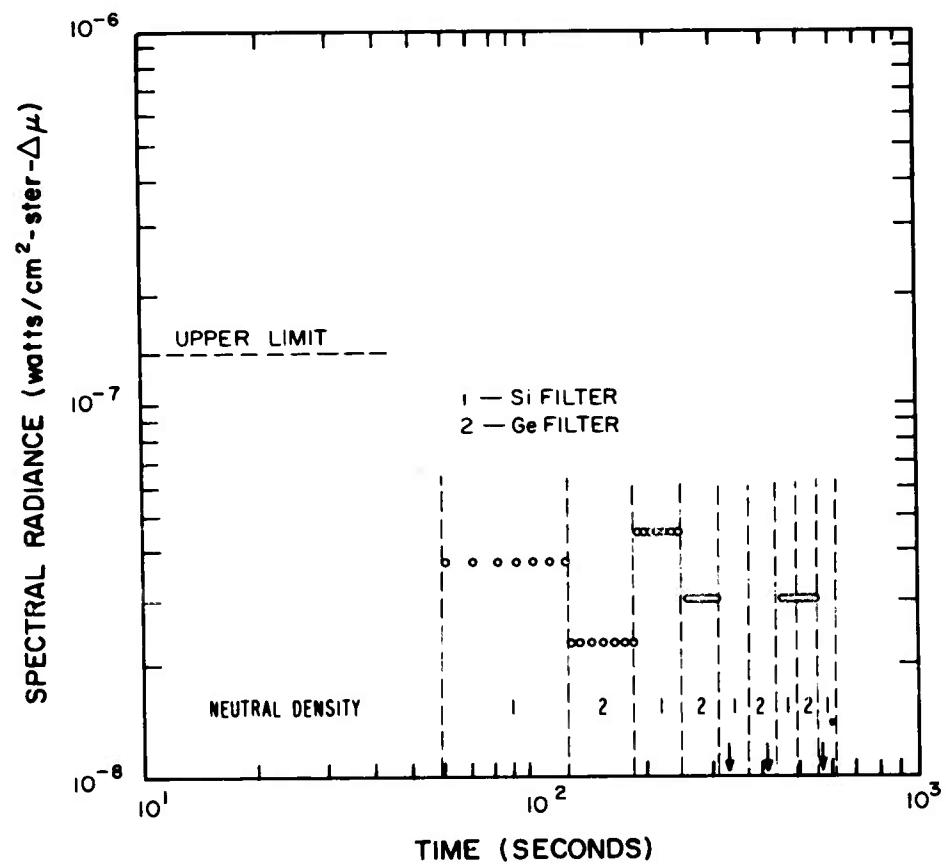


Figure 3.17 Spectral radiance, Kettle I, Star Fish Prime, Channel 7, late time.

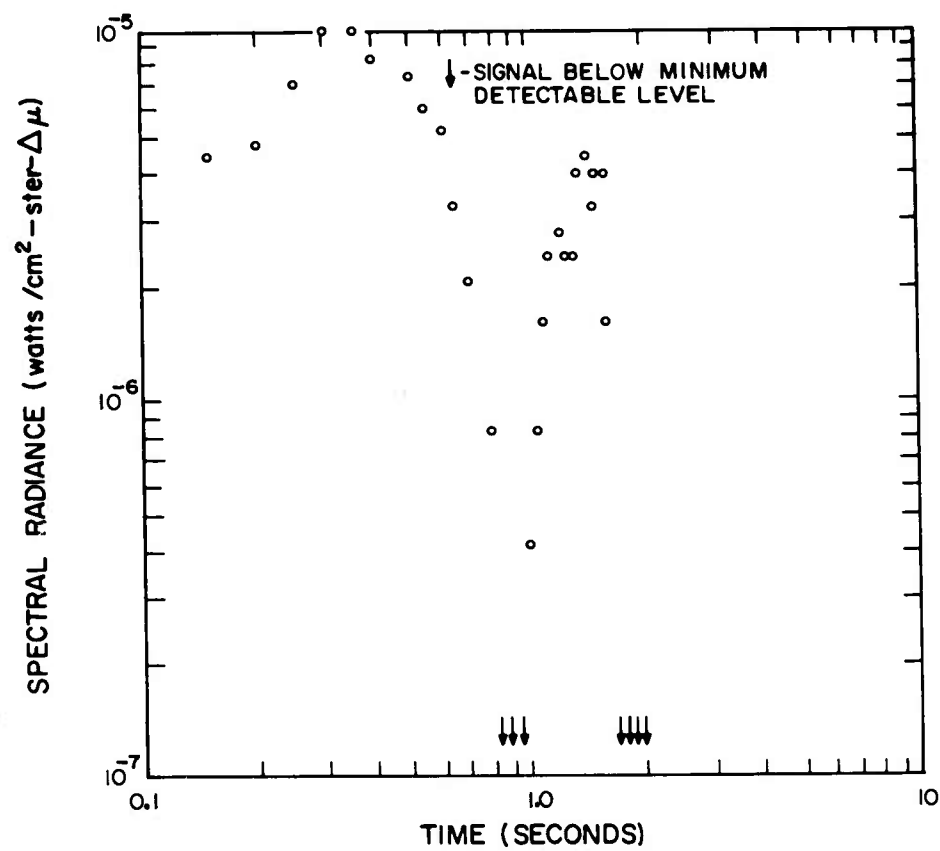


Figure 3.18 Spectral radiance, Kettle I, Star Fish Prime, Channel 8, early time.

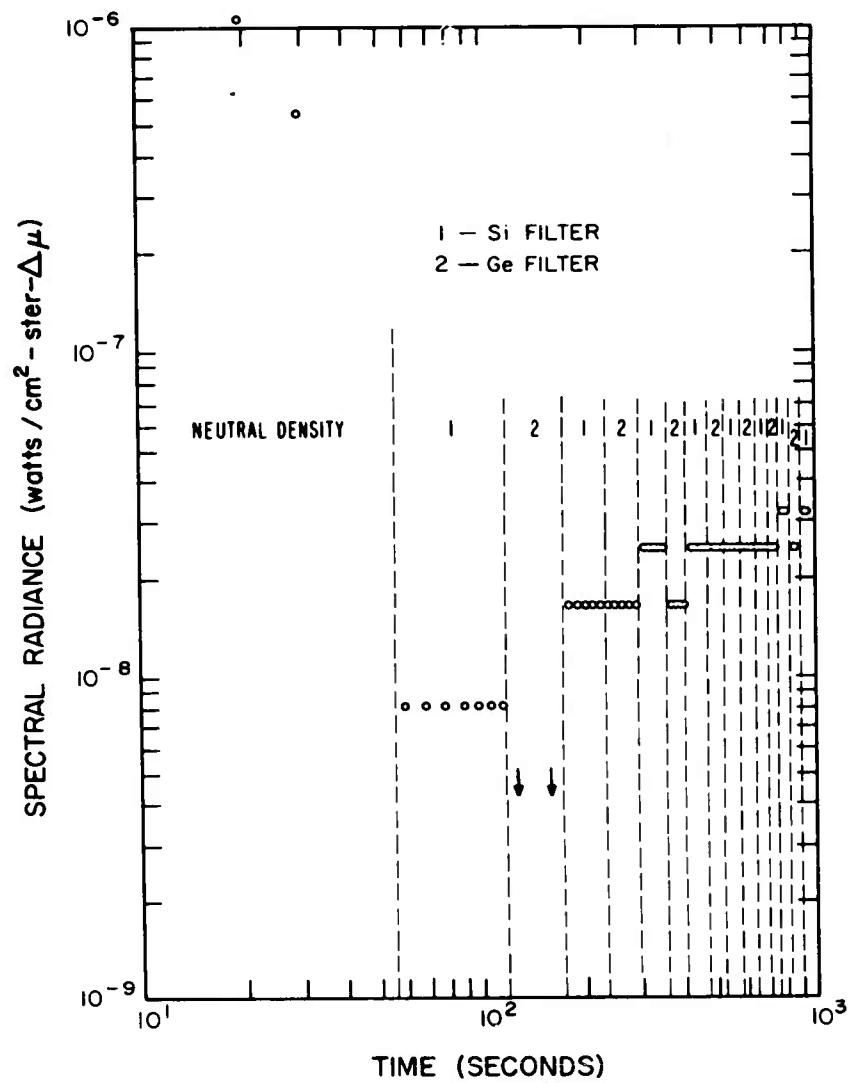


Figure 3.19 Spectral radiance, Kettle I, Star Fish Prime, Channel 8, late time.

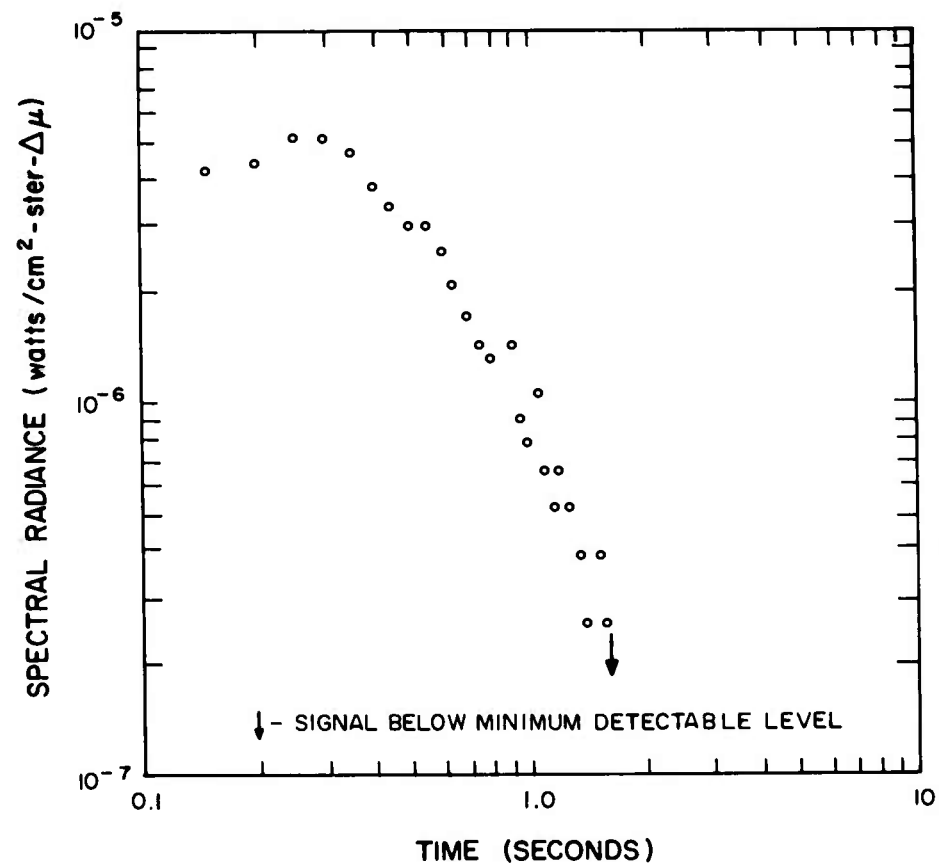


Figure 3.20 Spectral radiance, Kettle I, Star Fish Prime, Channel 9, early time.

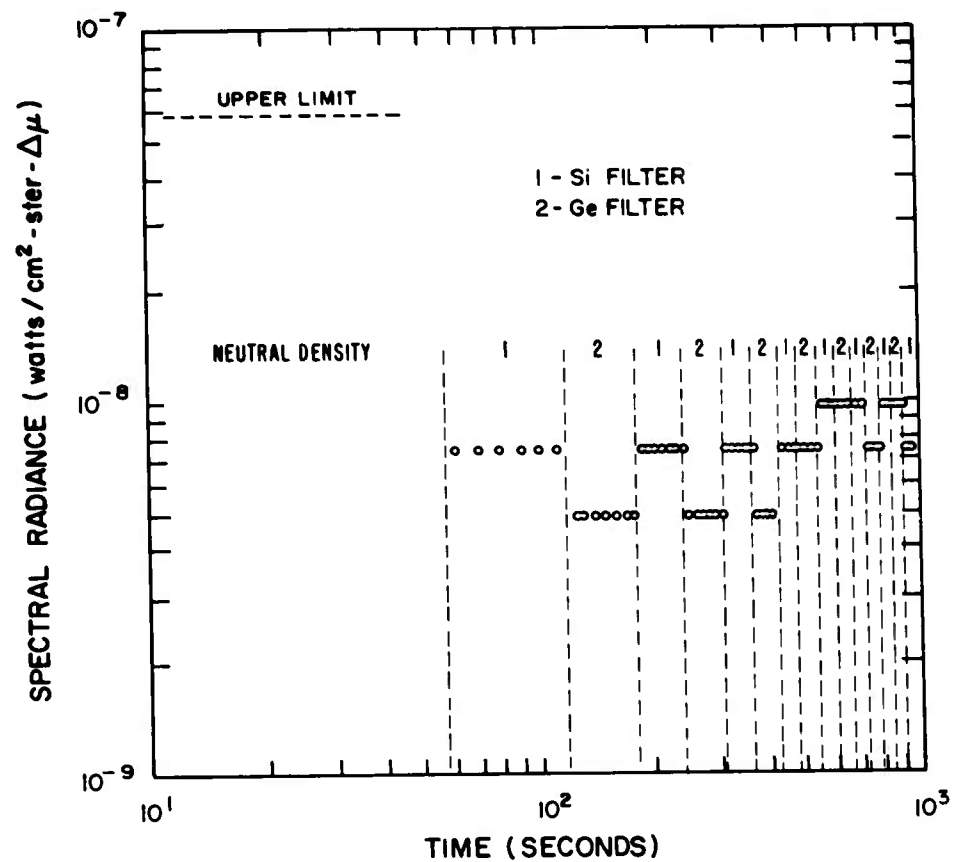


Figure 3.21 Spectral radiance, Kettle I, Star Fish Prime, Channel 9, late time.



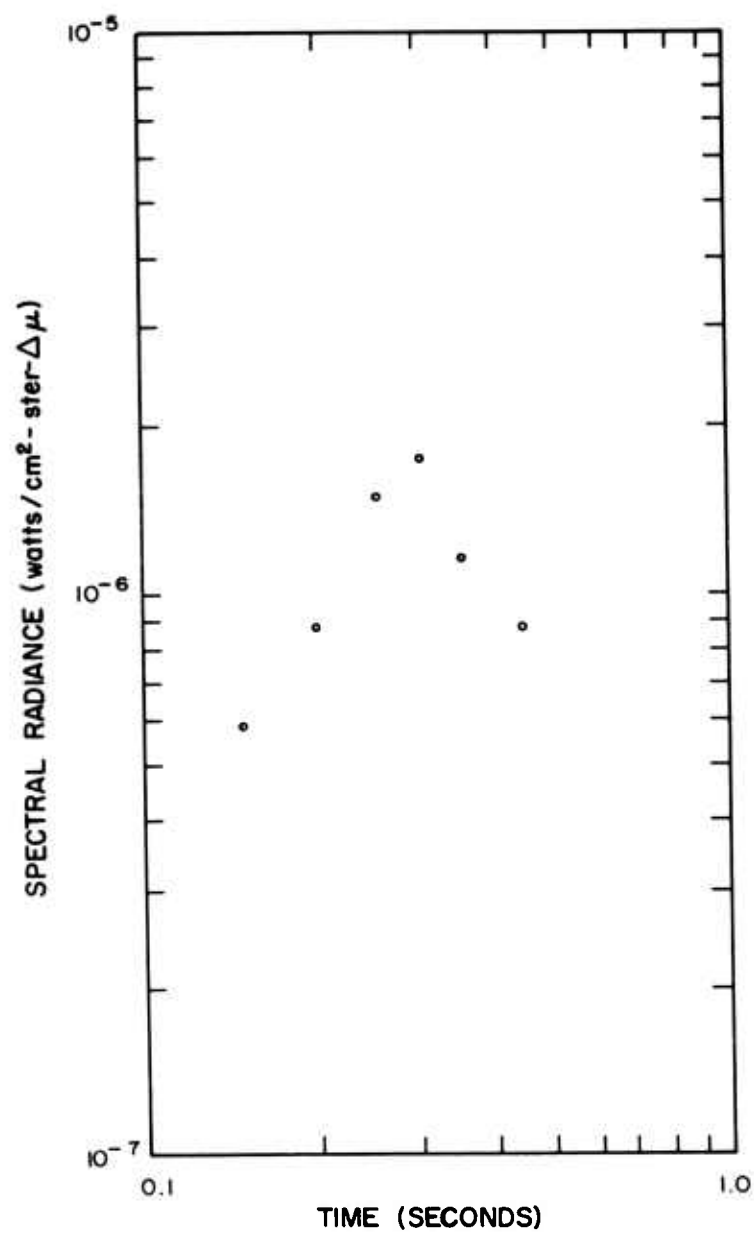
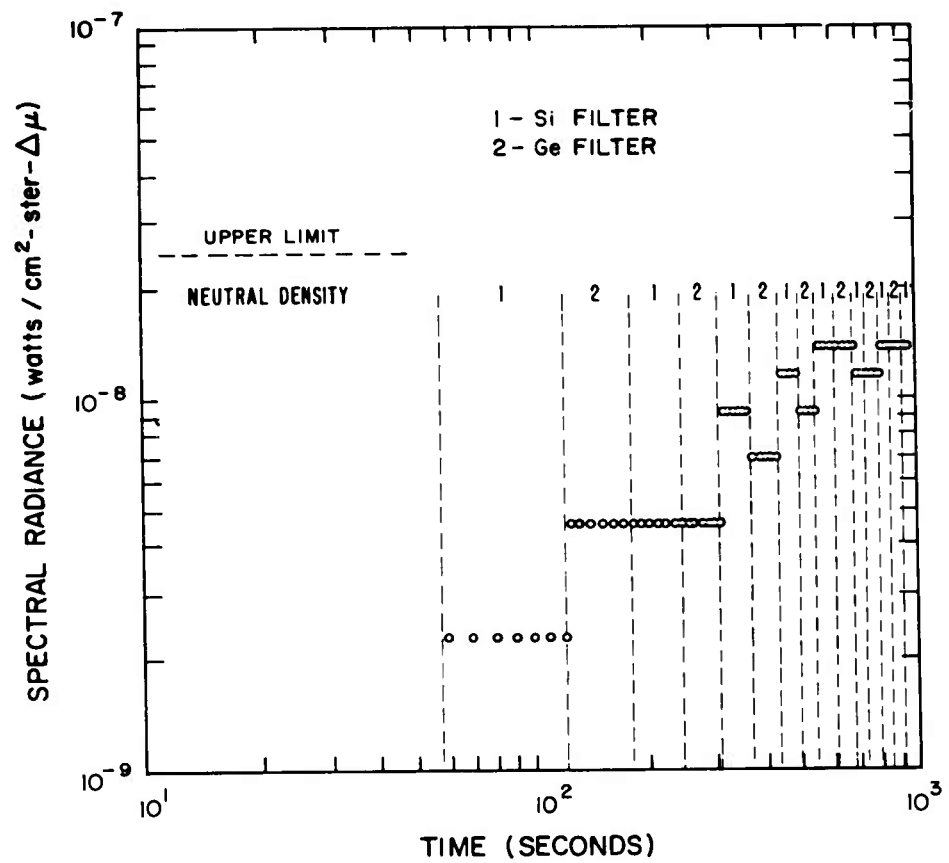


Figure 3.22 Spectral radiance, Kettle I, Star Fish Prime, Channel 10, early time.



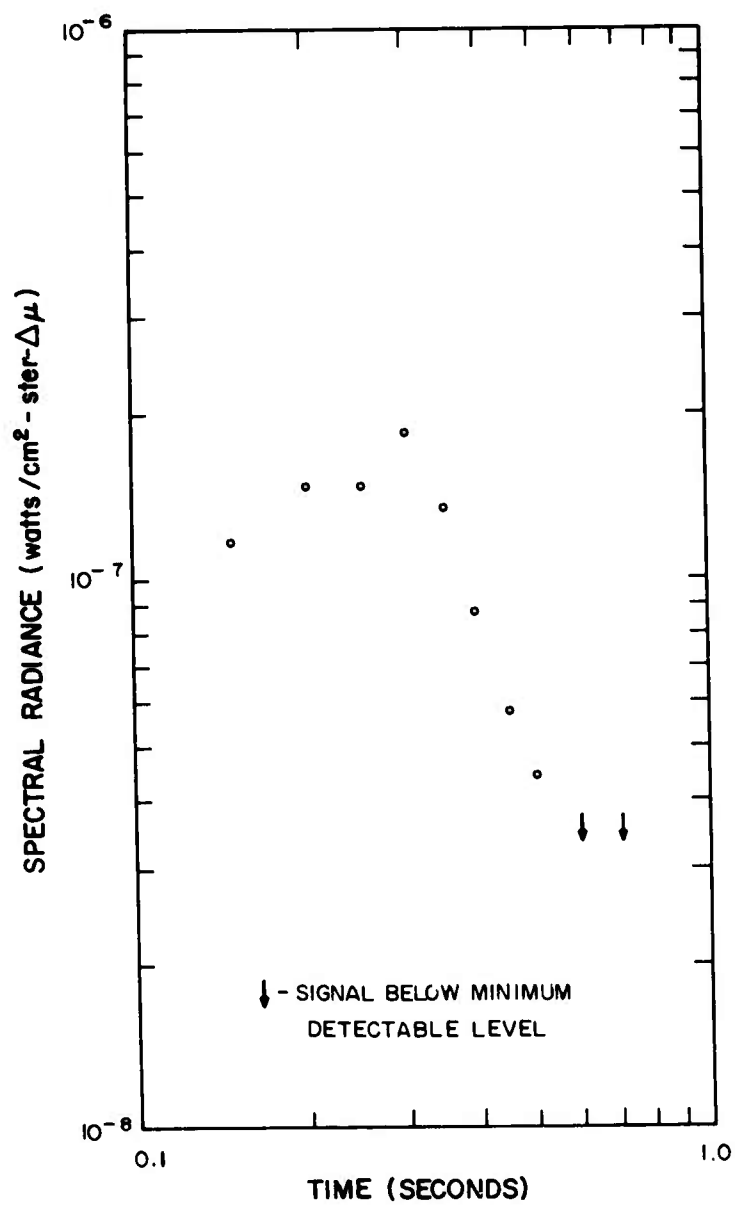


Figure 3.24 Spectral radiance, Kettle I, Star Fish Prime, Channel 11; early time.

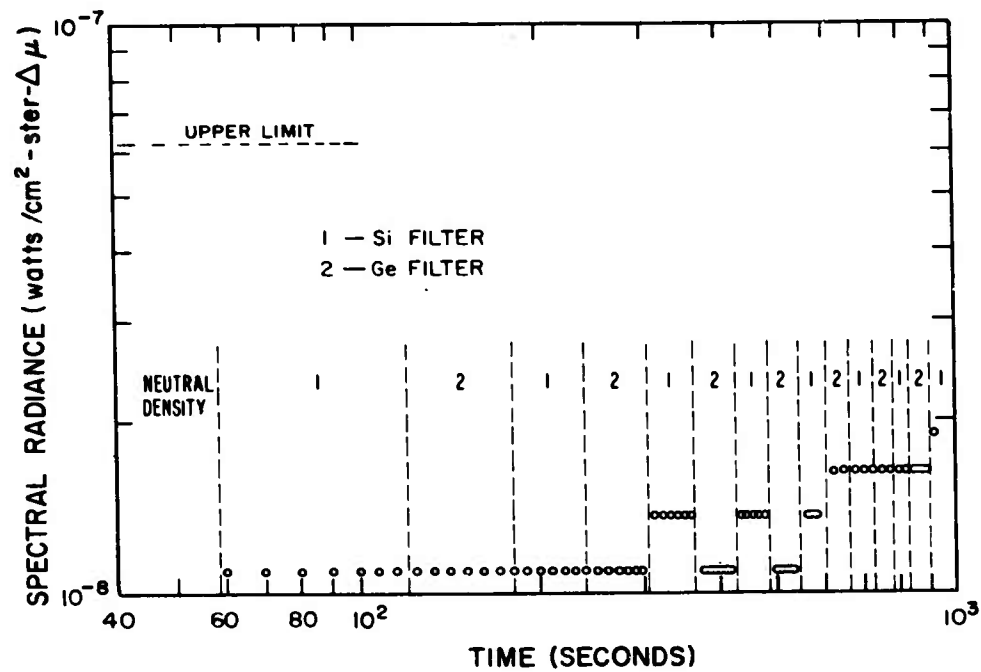


Figure 3.25 Spectral radiance, Kettle I, Star Fish Prime, Channel 11, late time.

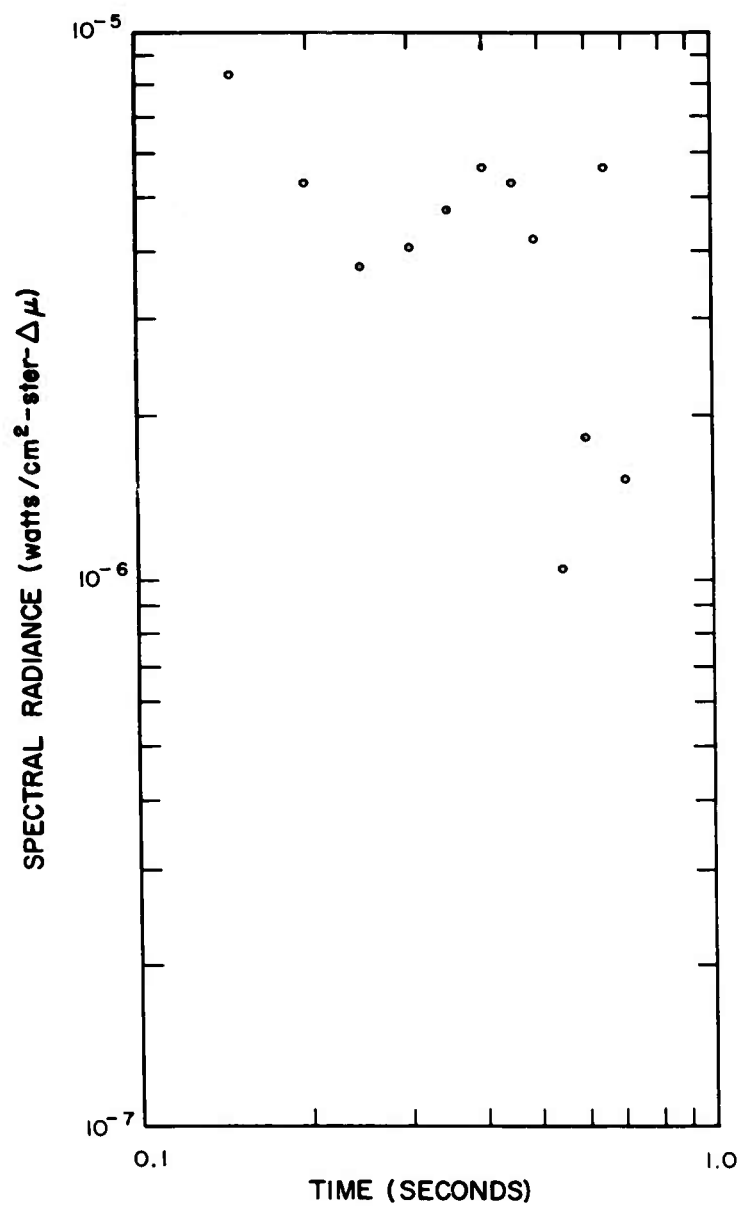


Figure 3.26 Spectral radiance, Kettle I, Star Fish Prime, Channel 13, early time.

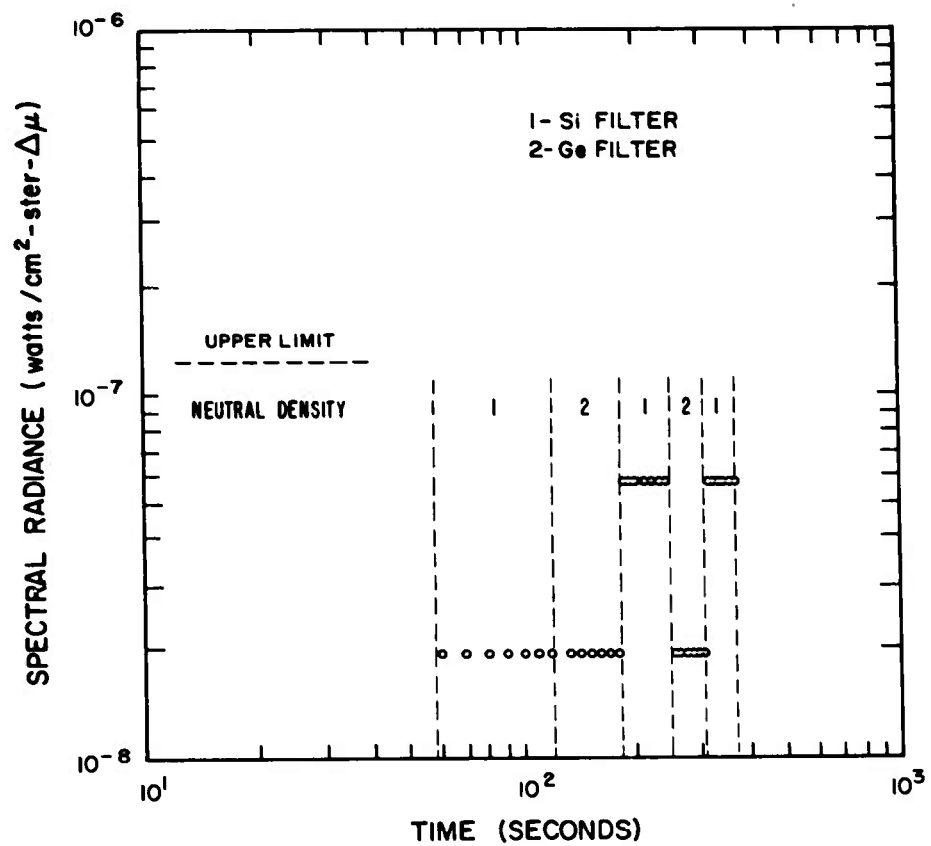


Figure 3.27 Spectral radiance, Kettle I, Star Fish Prime, Channel 13, late time.

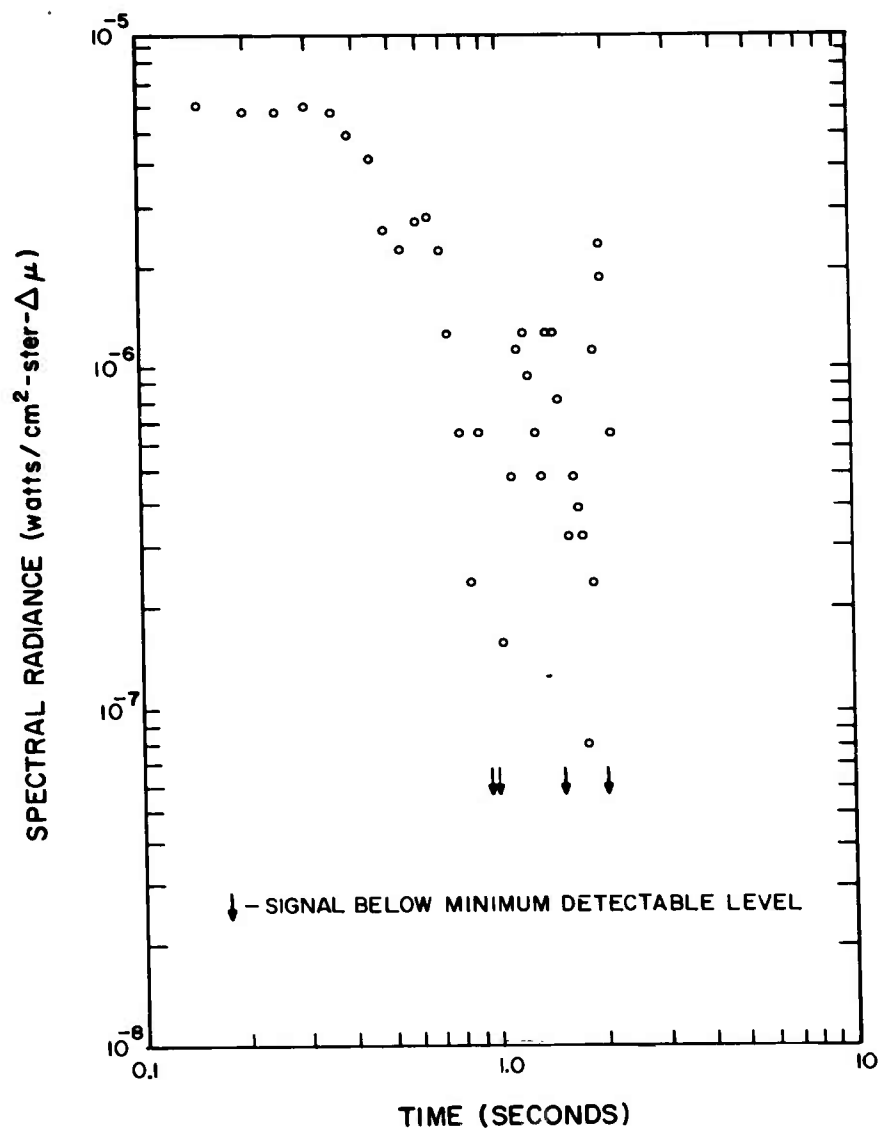


Figure 3.28 Spectral radiance, Kettle I, Star Fish Prime, Channel 14, early time.

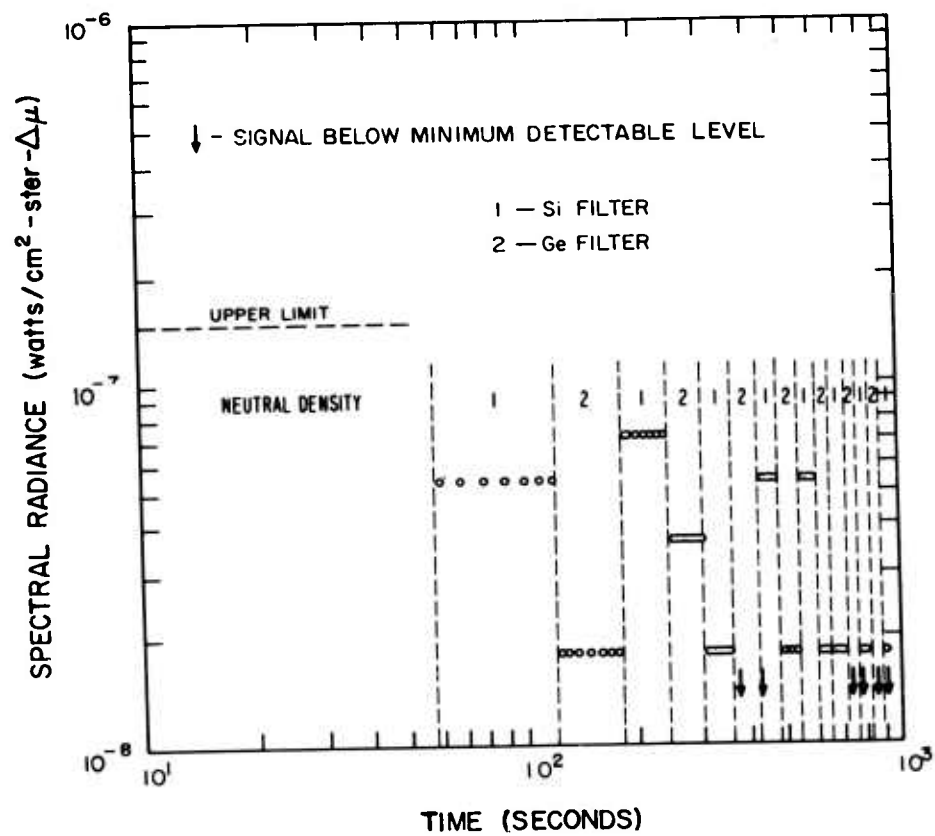
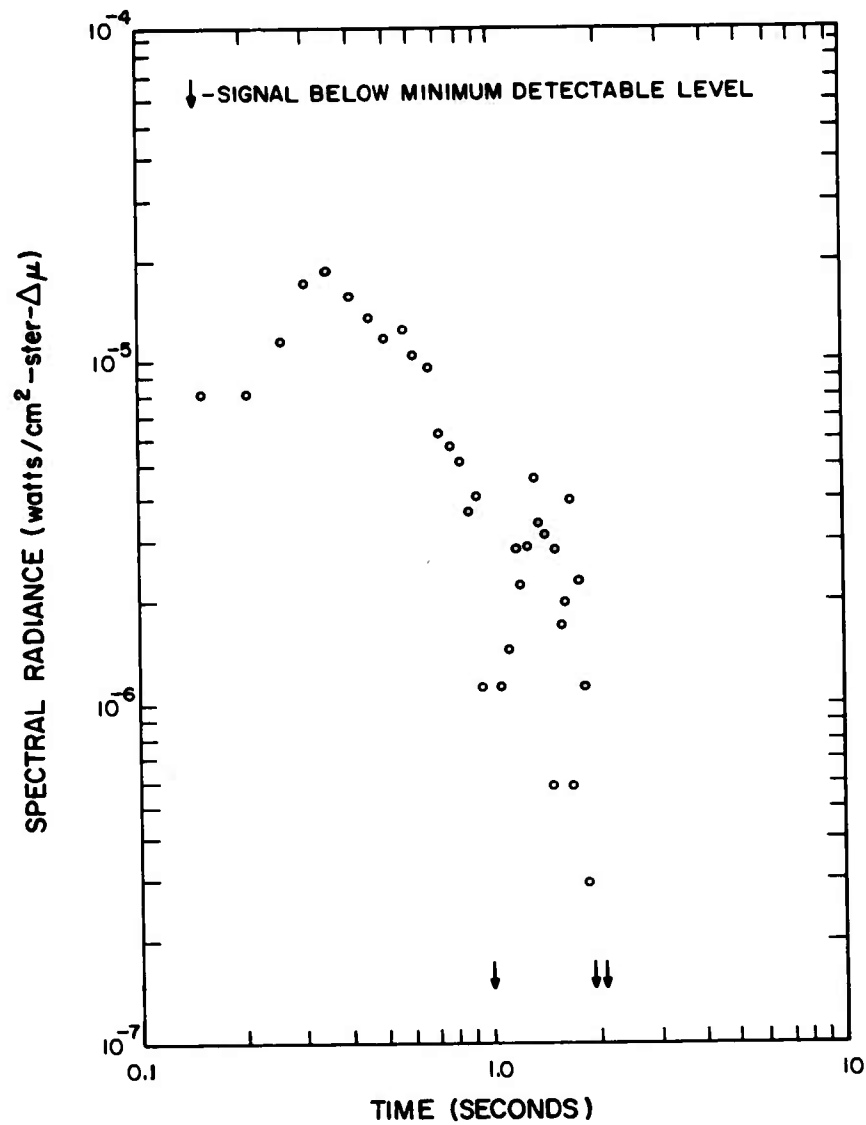


Figure 3.29 Spectral radiance, Kettle I, Star Fish Prime, Channel 14, late time.





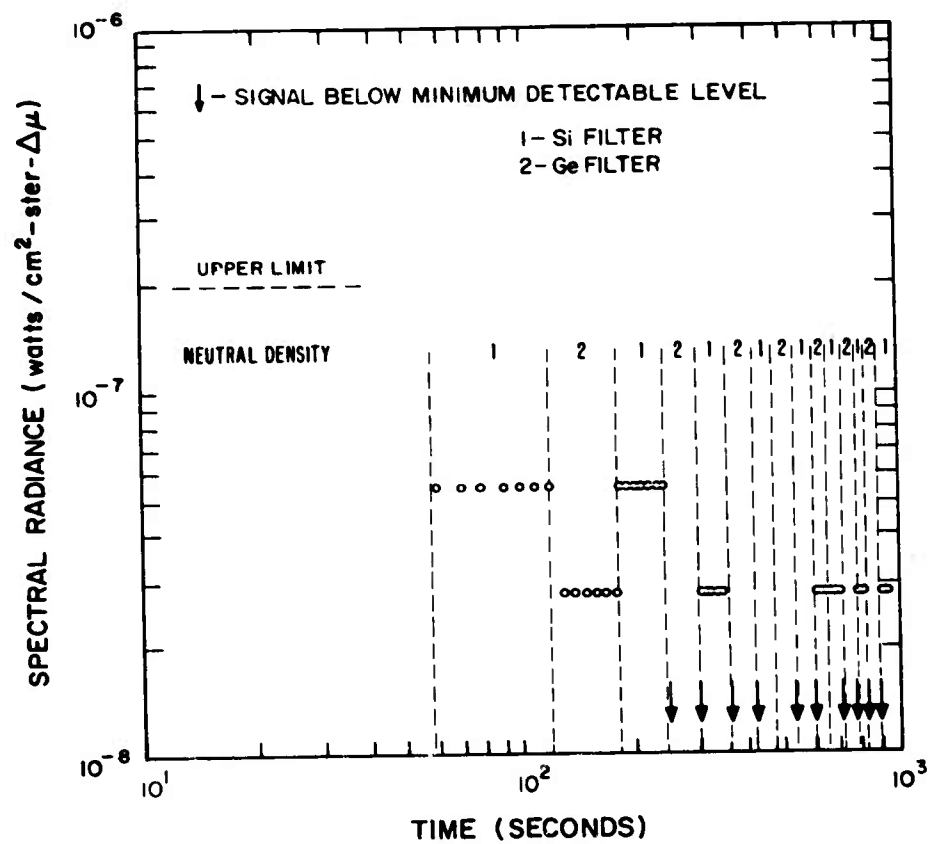


Figure 3.31 Spectral radiance, Kettle I, Star Fish Prime, Channel 15, late time.

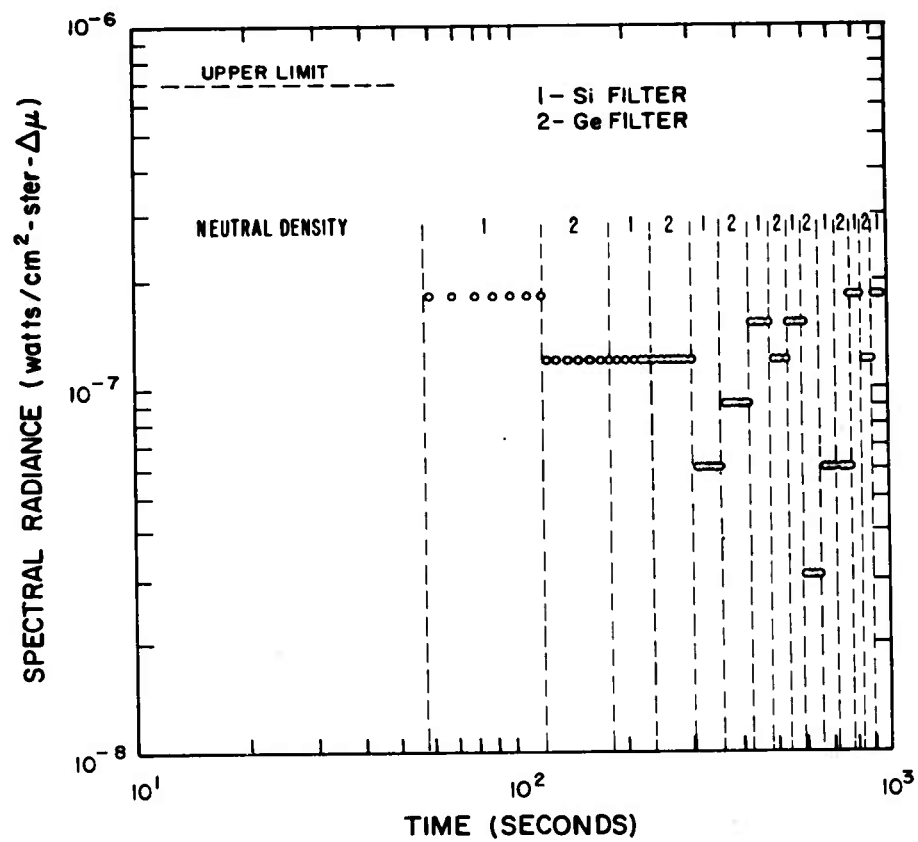


Figure 3.32 Spectral radiance, Kettle I, Star Fish Prime, Channel 16.

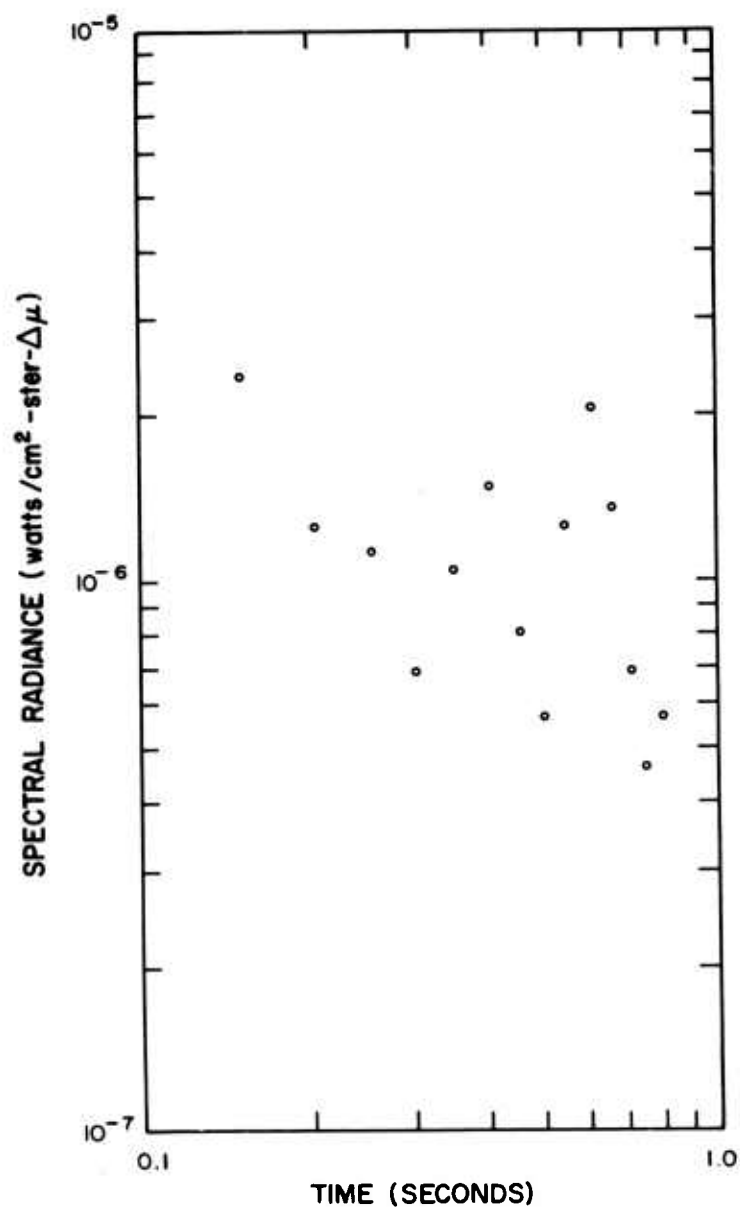


Figure 3.33 Spectral radiance, Kettle I, Star Fish Prime, Channel 17.

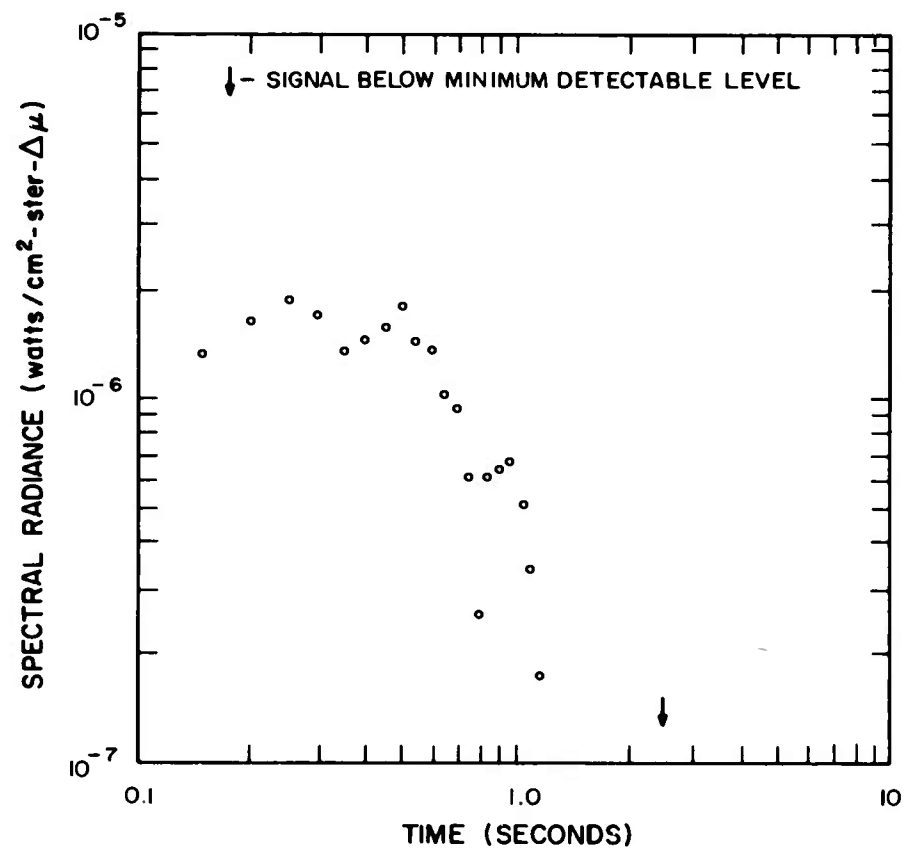


Figure 3.34 Spectral radiance, Kettle I, Star Fish Prime, Channel 18, early time.

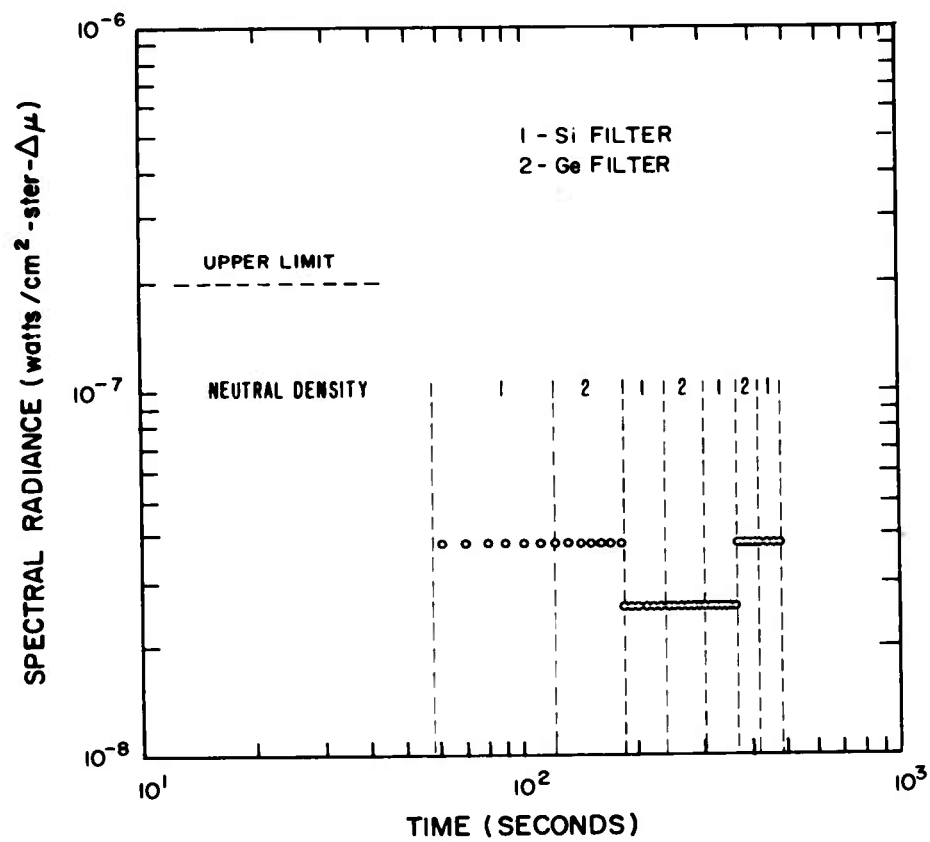


Figure 3.35 Spectral radiance, Kettle I, Star Fish Prime, Channel 18, late time.

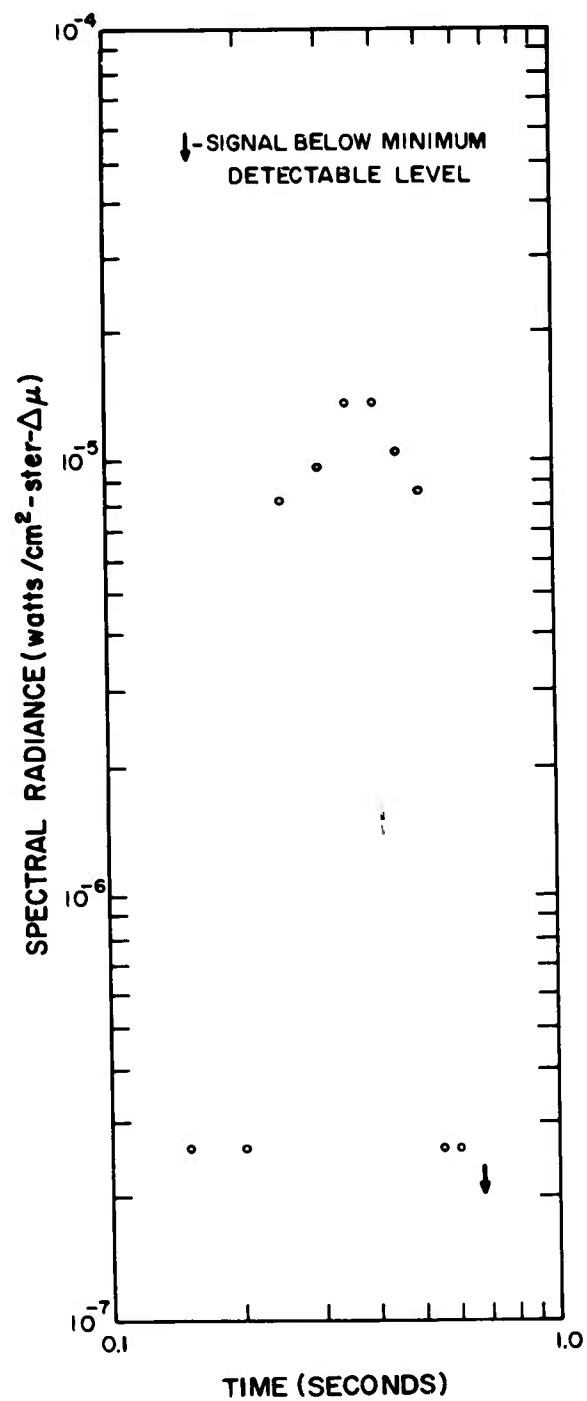


Figure 3.36 Spectral radiance, Kettle I, Star Fish Prime, Channel 19.

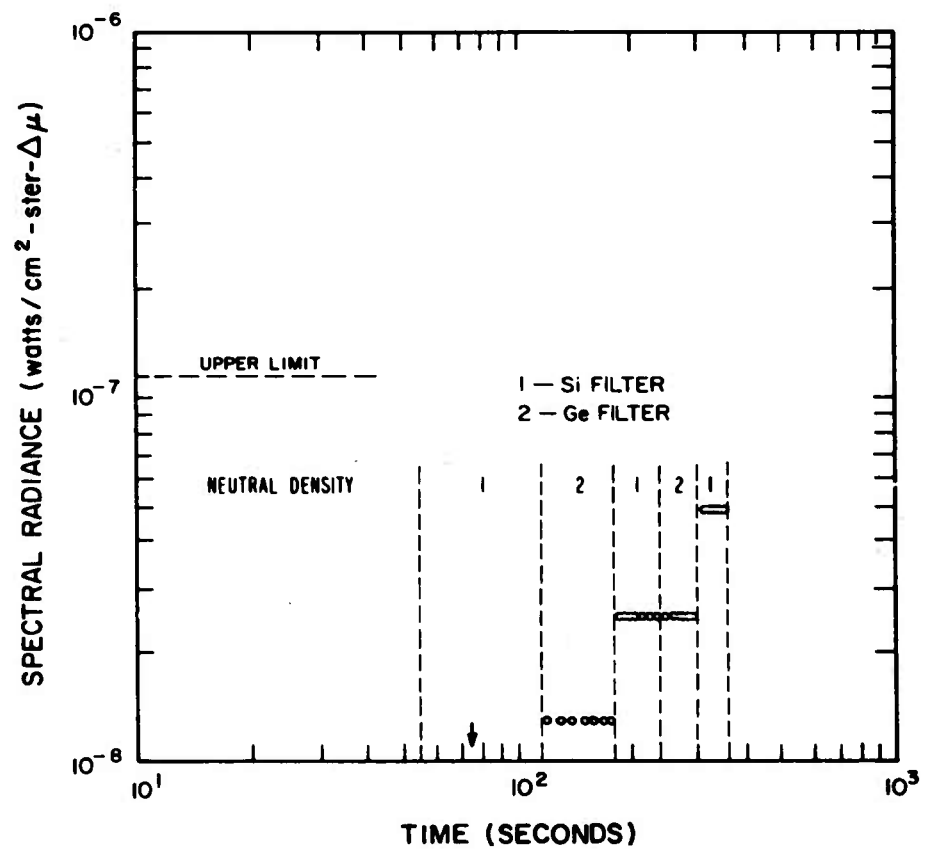


Figure 3.37 Spectral radiance, Kettle I, Star Fish Prime, Channel 19, late time.



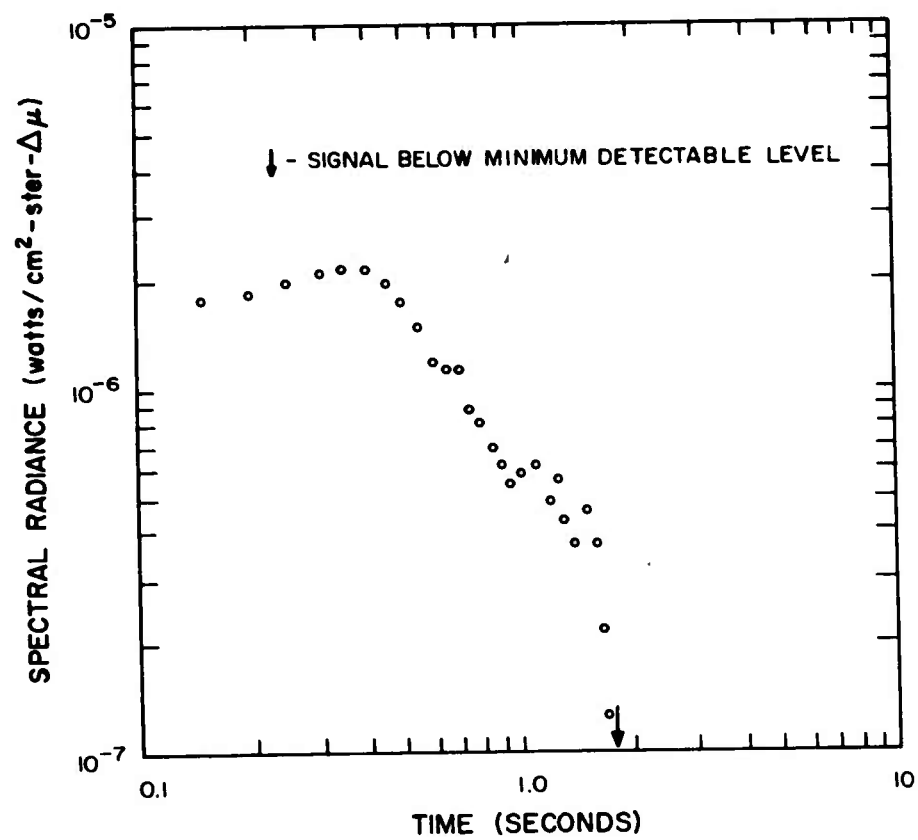


Figure 3.38 Spectral radiance, Kettle I, Star Fish Prime, Channel 20.

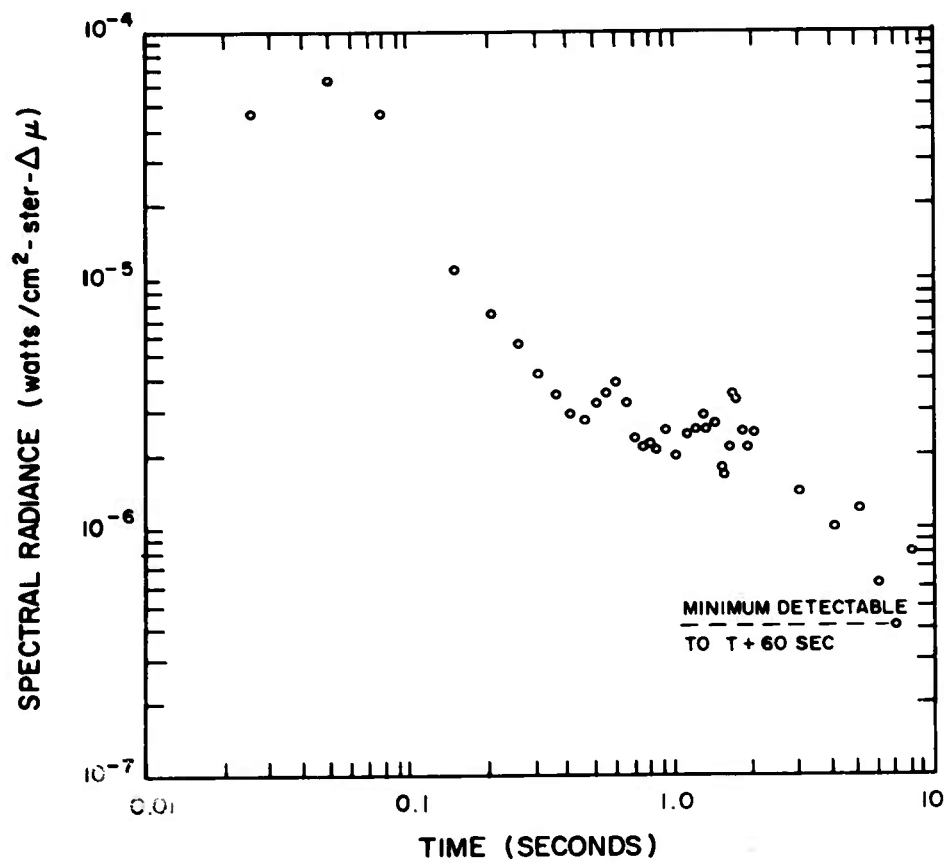


Figure 3.39 Spectral radiance, Kettle II, Star Fish Prime, Channel 1.



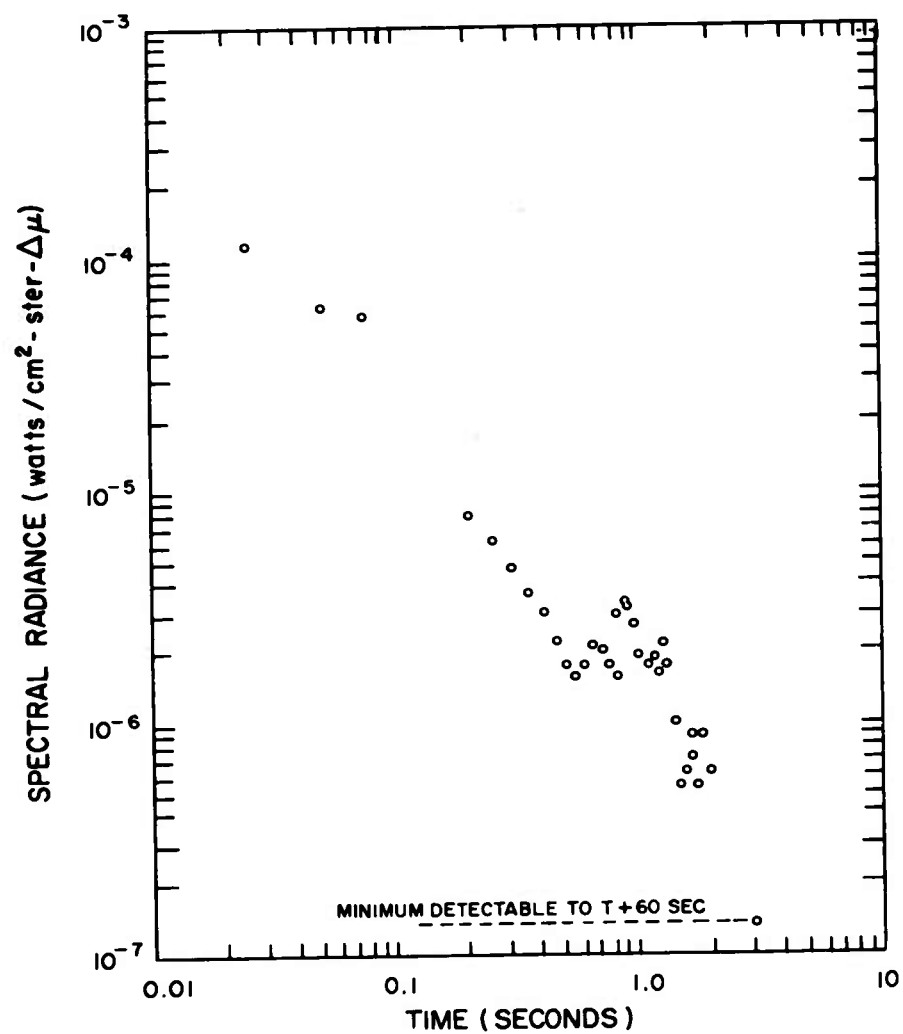


Figure 3.41 Spectral radiance, Kettle II, Star Fish Prime, Channel 2, early time.

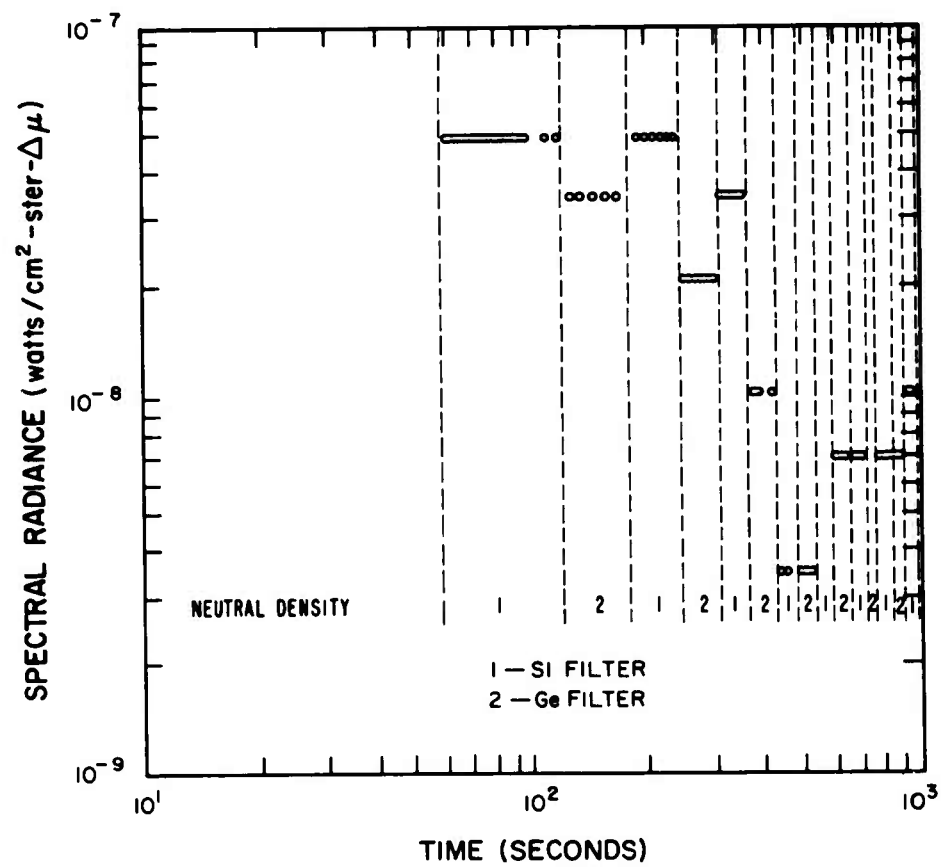


Figure 3.42 Spectral radiance, Kettle II, Star Fish Prime, Channel 2, late time.

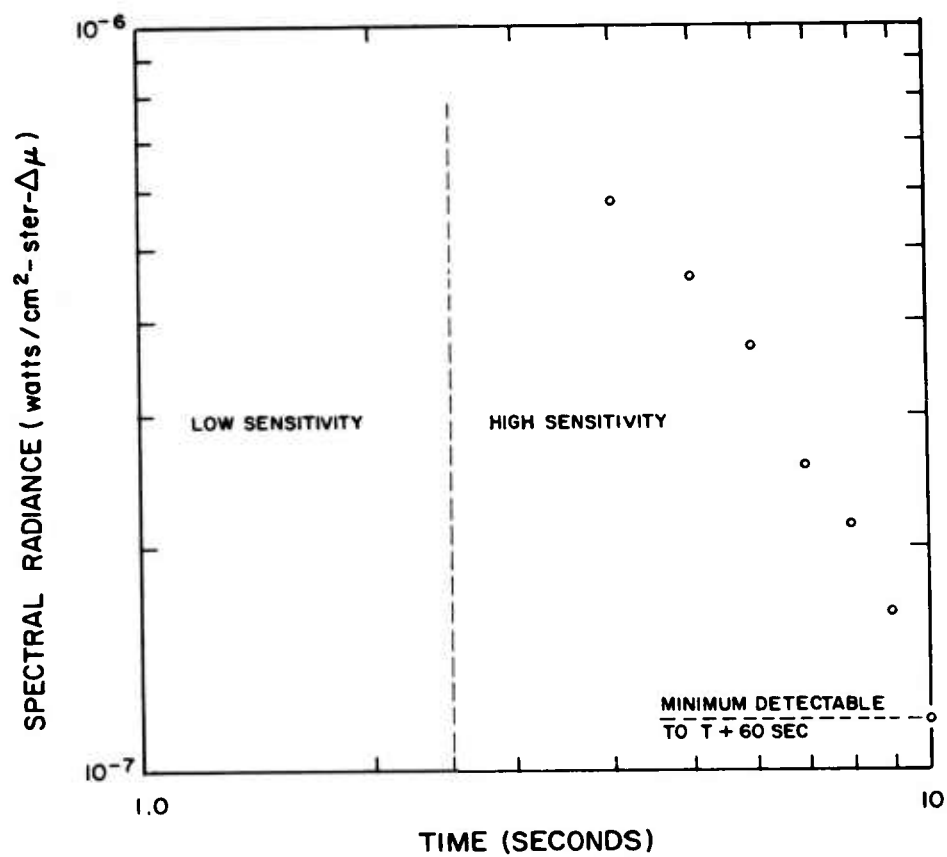


Figure 3.43 Spectral radiance, Kettle II, Star Fish Prime, Channel 3, early time.

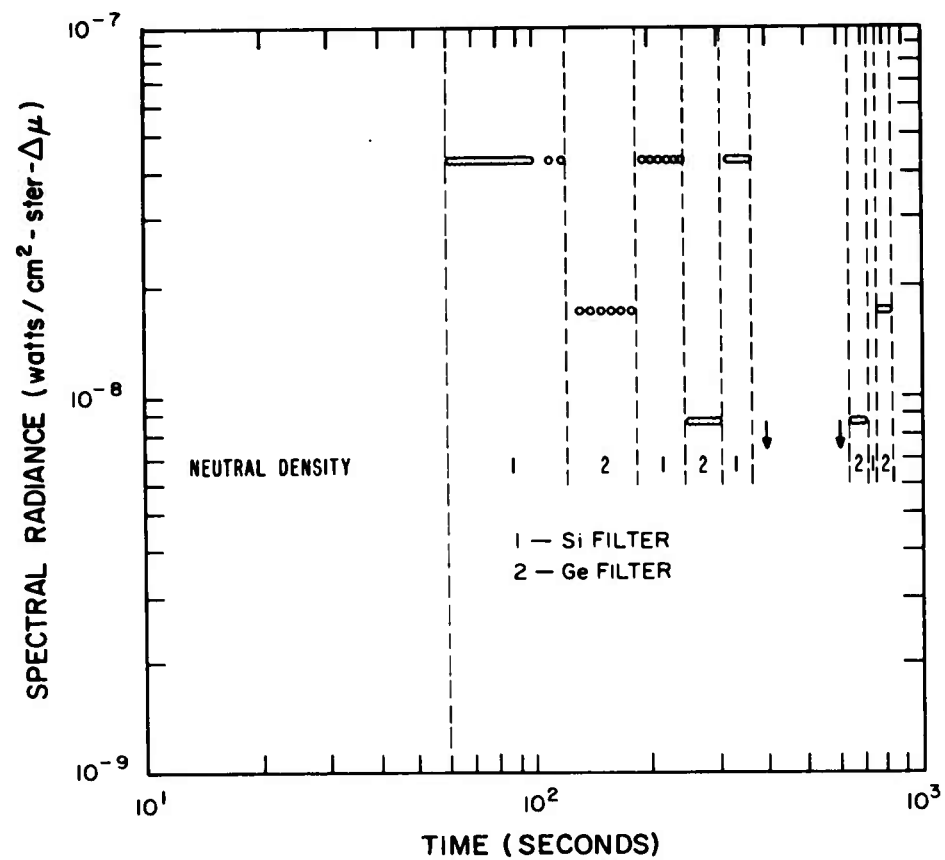


Figure 3.44 Spectral radiance, Kettle II, Star Fish Prime, Channel 3, late time.

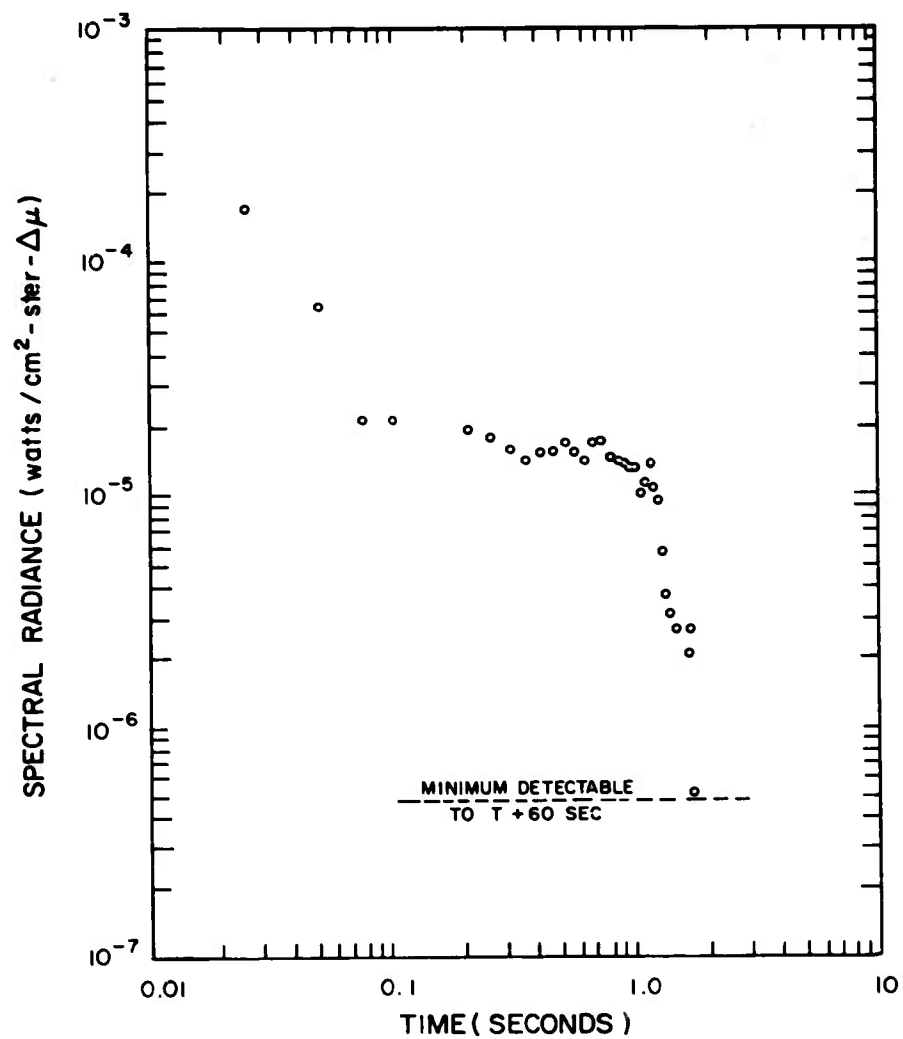


Figure 3.45 Spectral radiance, Kettle II, Star Fish Prime, Channel 4, early time.



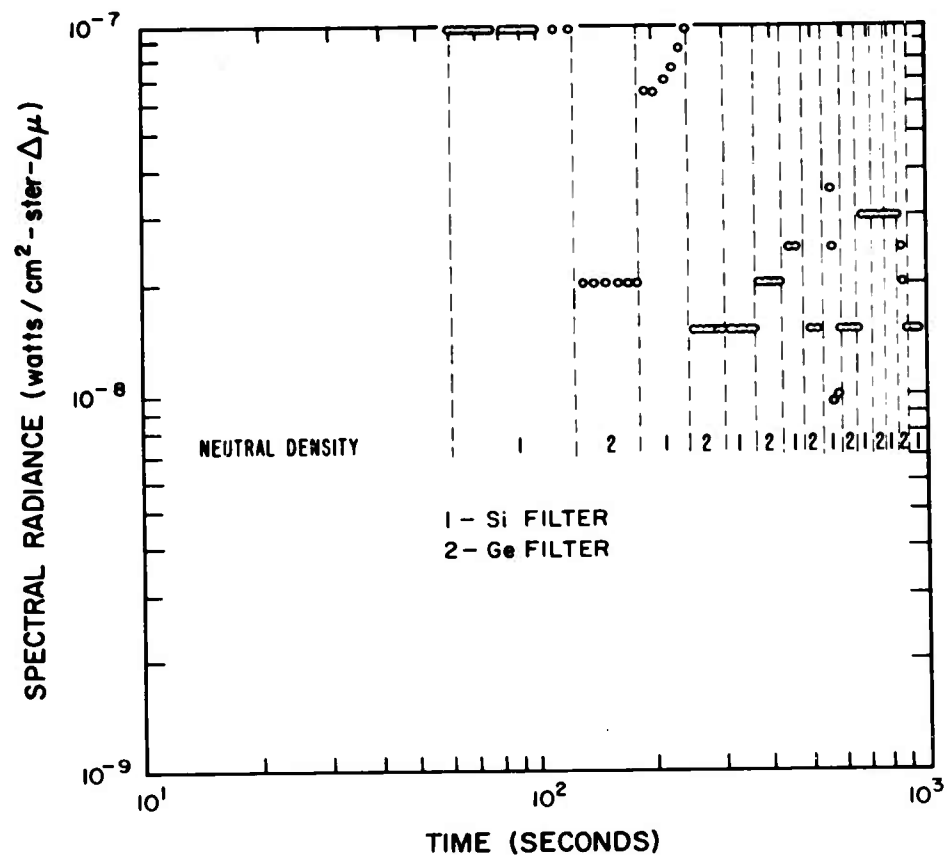


Figure 3.46 Spectral radiance, Kettle II, Star Fish Prime, Channel 4, late time.

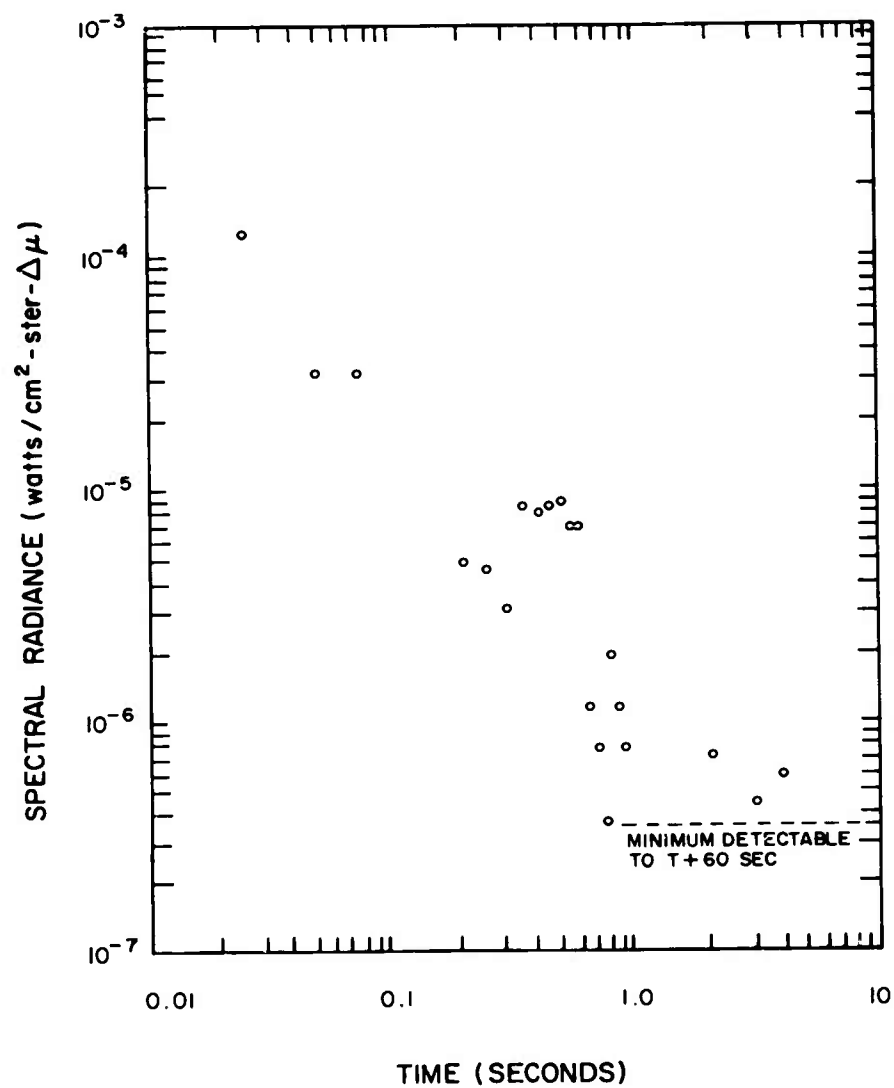


Figure 3.47 Spectral radiance, Kettle II, Star Fish Prime, Channel 5, early time.

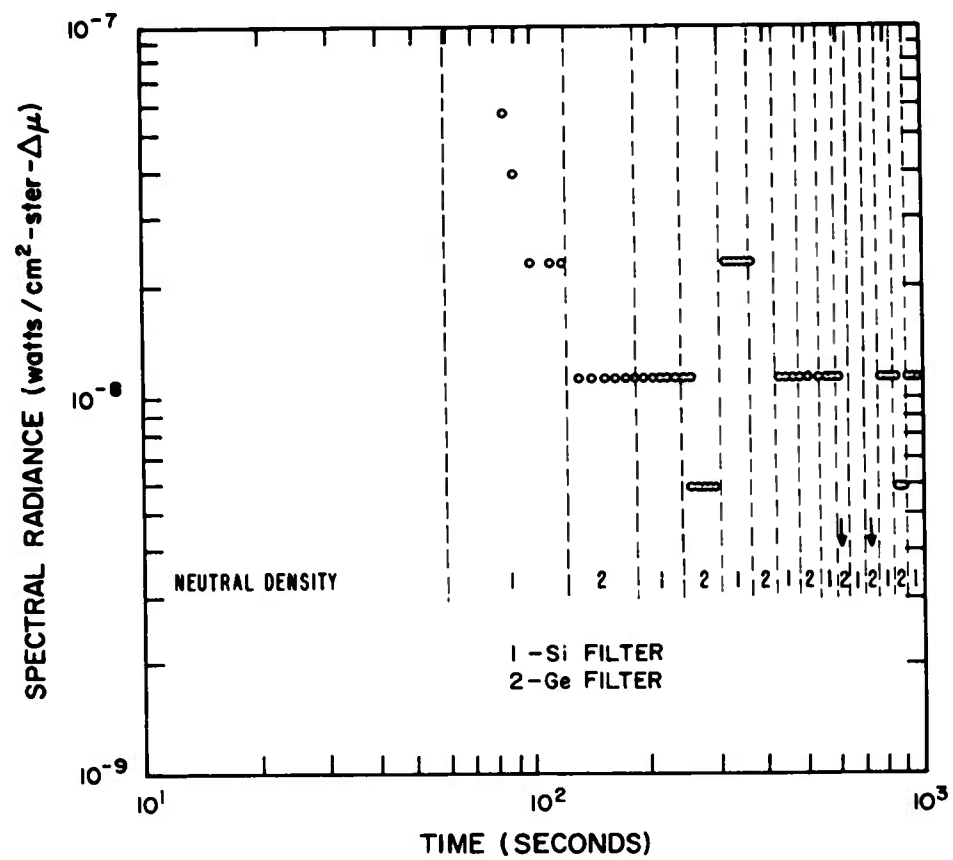


Figure 3.48 Spectral radiance, Kettle II, Star Fish Prime, Channel 5, late time.

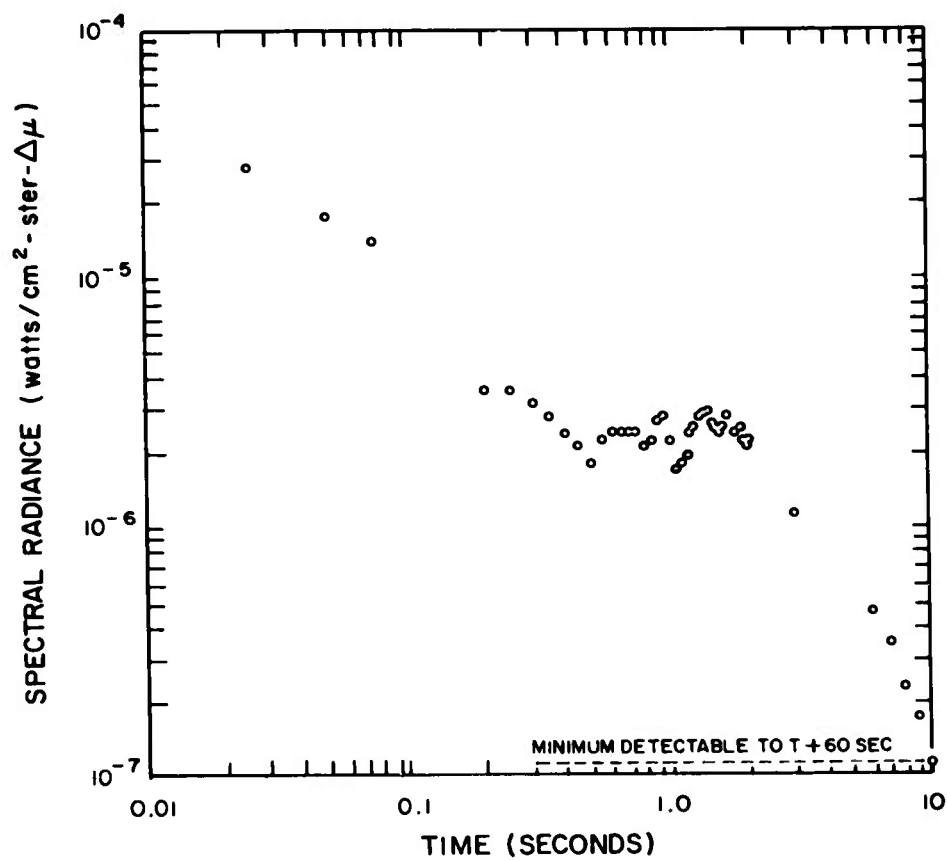


Figure 3.49 Spectral radiance, Kettle II, Star Fish Prime, Channel 6, early time.

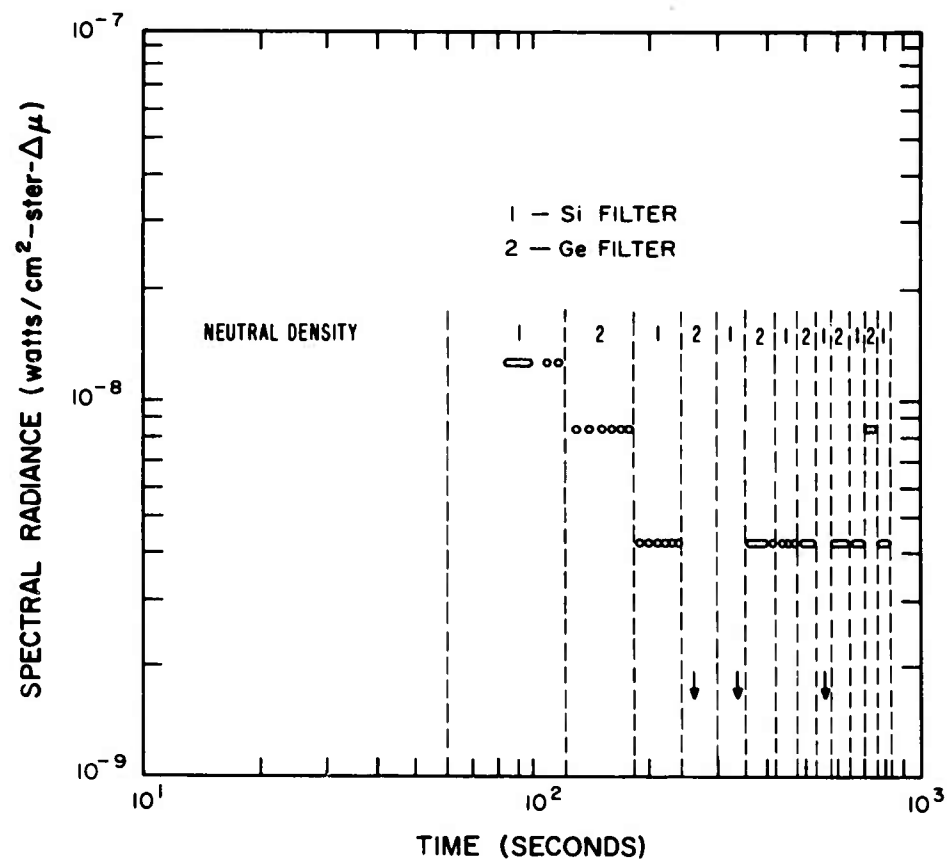


Figure 3.50 Spectral radiance, Kettle II, Star Fish Prime, Channel 6, late time.

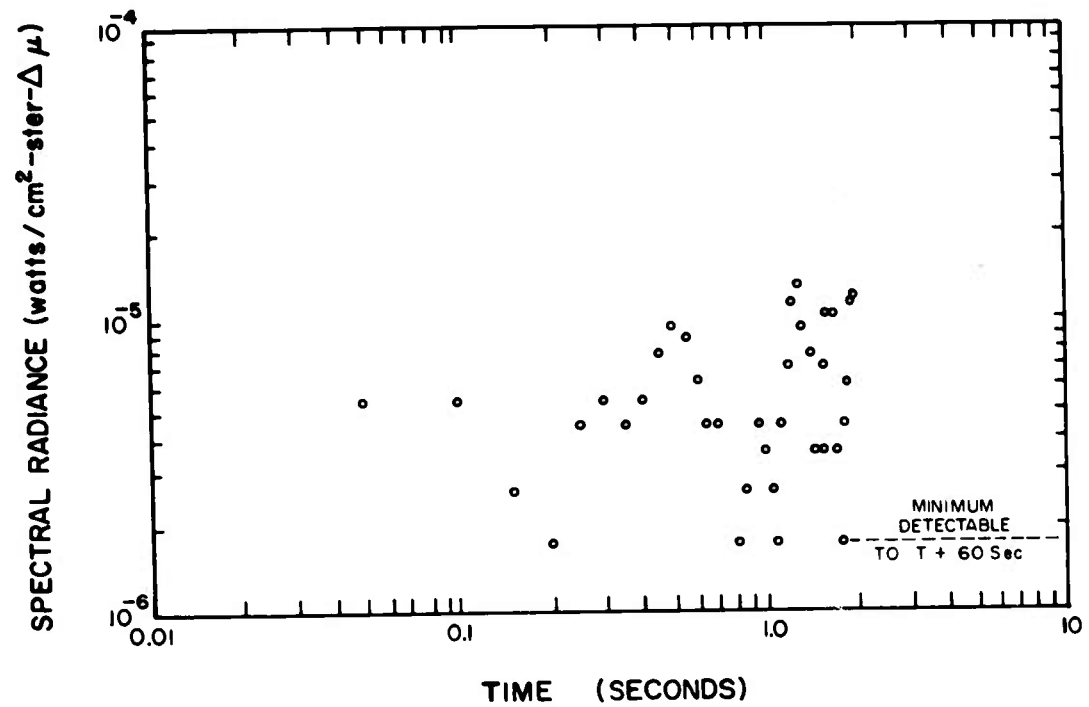


Figure 3.51 Spectral radiance, Kettle II, Star Fish Prime, Channel 7, early time.

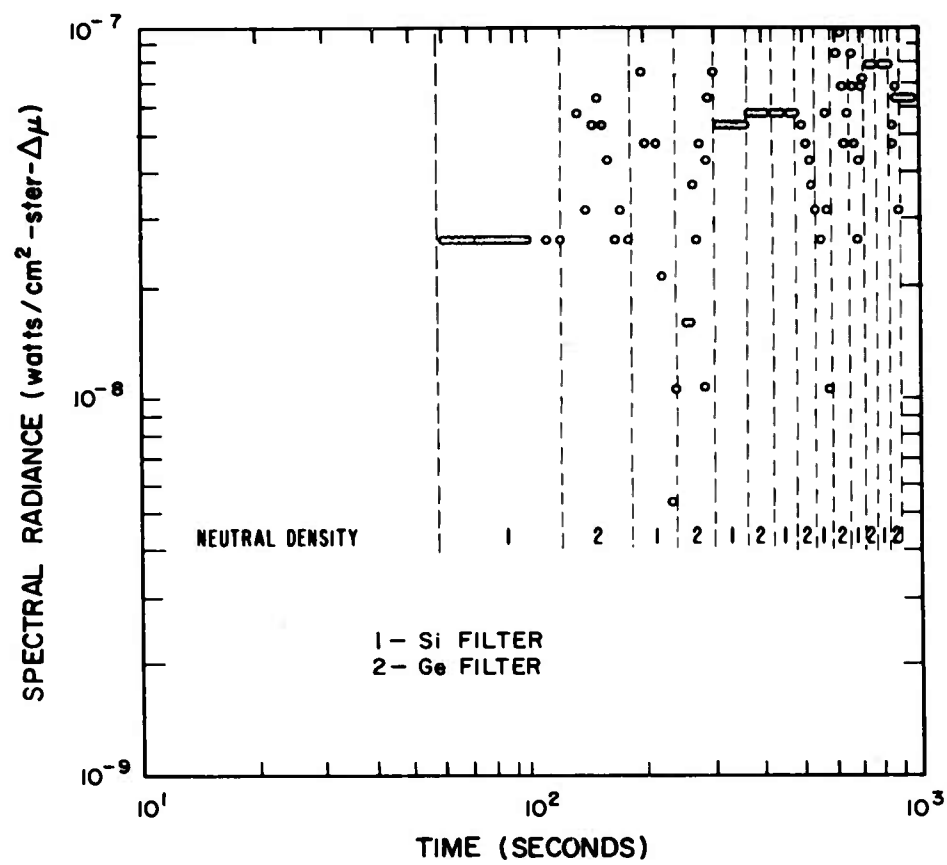


Figure 3.52 Spectral radiance, Kettle II, Star Fish Prime, Channel 7, late time.

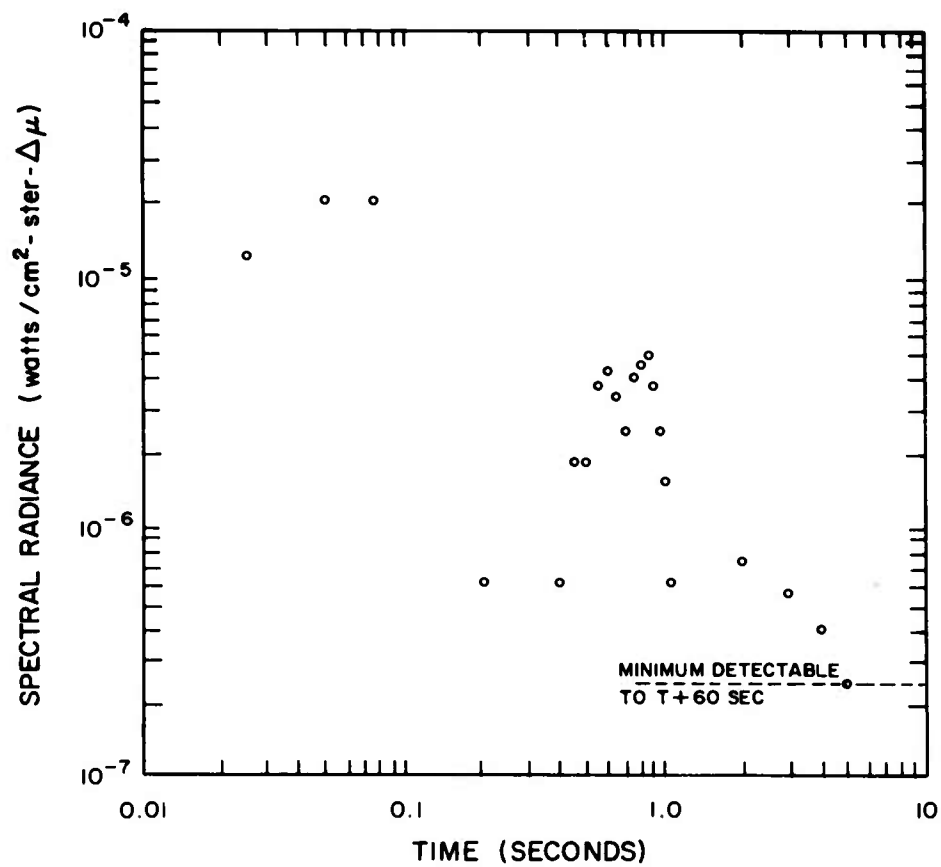


Figure 3.53 Spectral radiance, Kettle II, Star Fish Prime, Channel 8, early time.



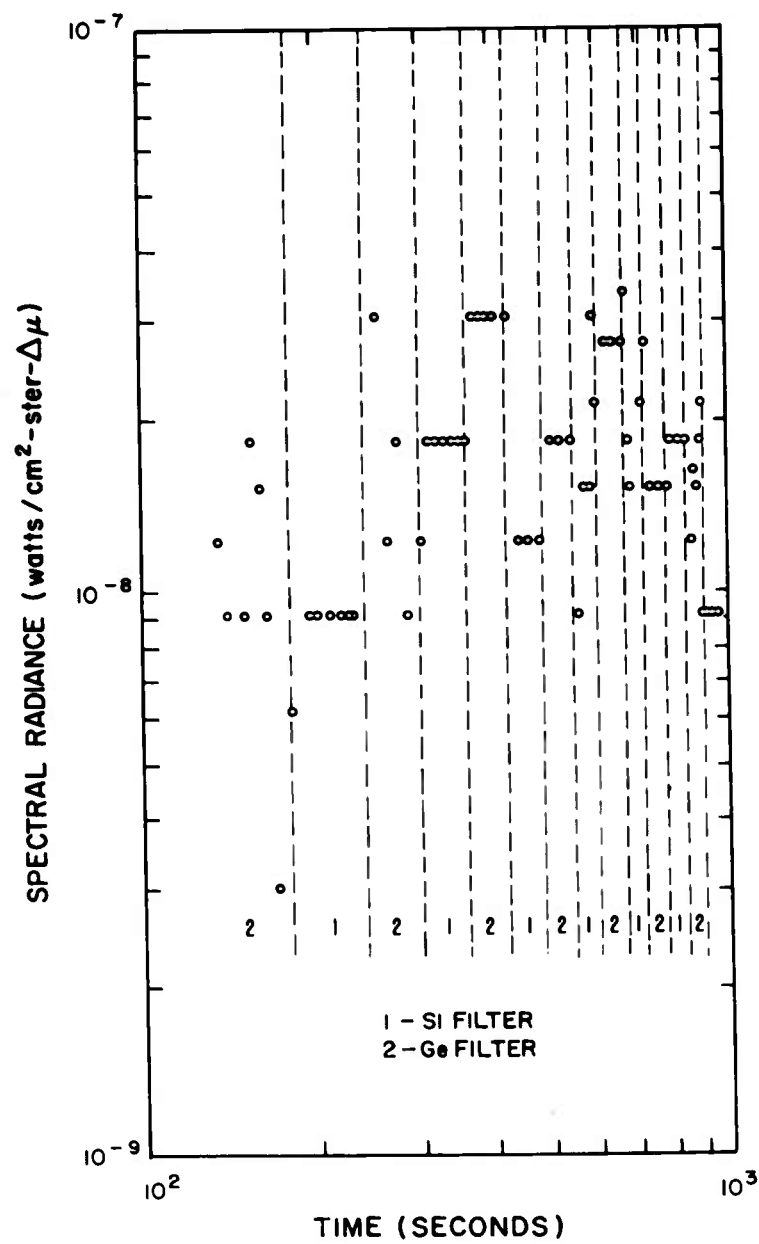


Figure 3.54 Spectral radiance, Kettle II, Star Fish Prime, Channel 8, late time.

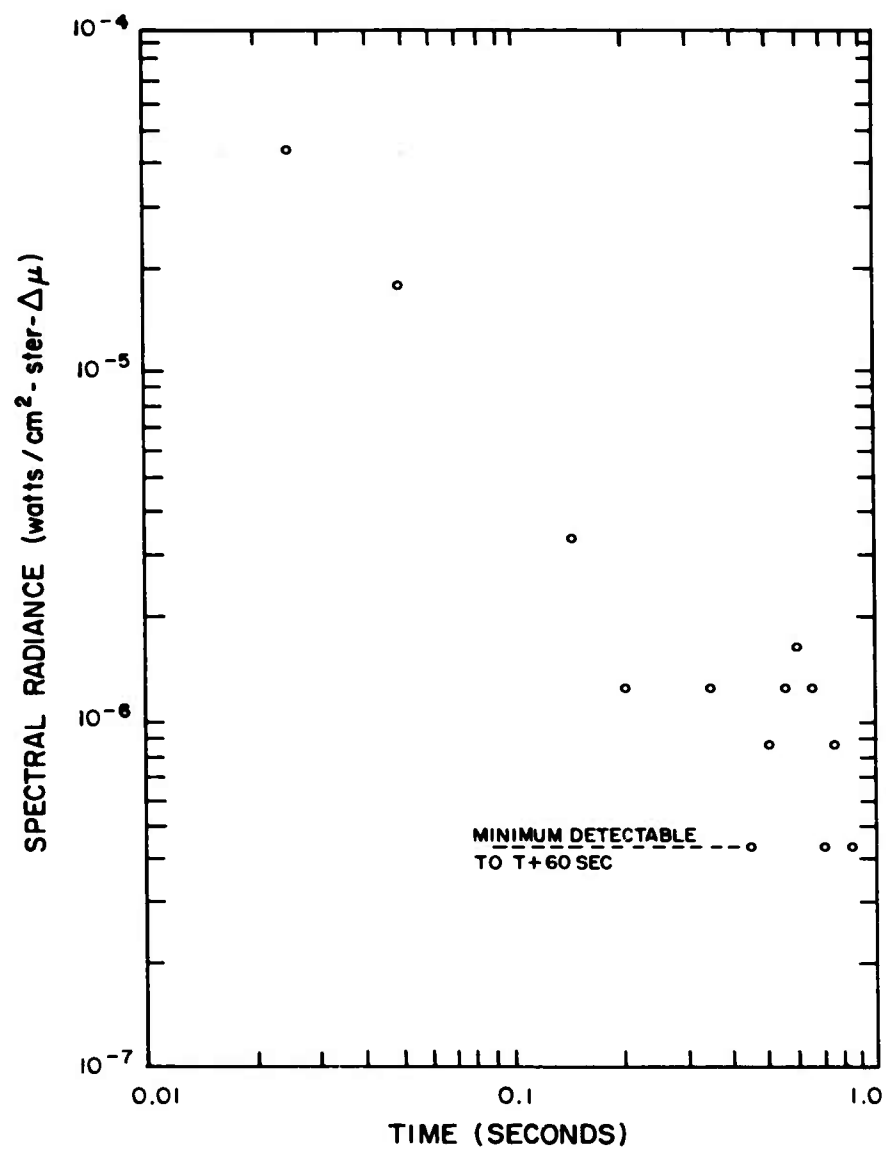


Figure 3.55 Spectral radiance, Kettle II, Star Fish Prime, Channel 9, early time.

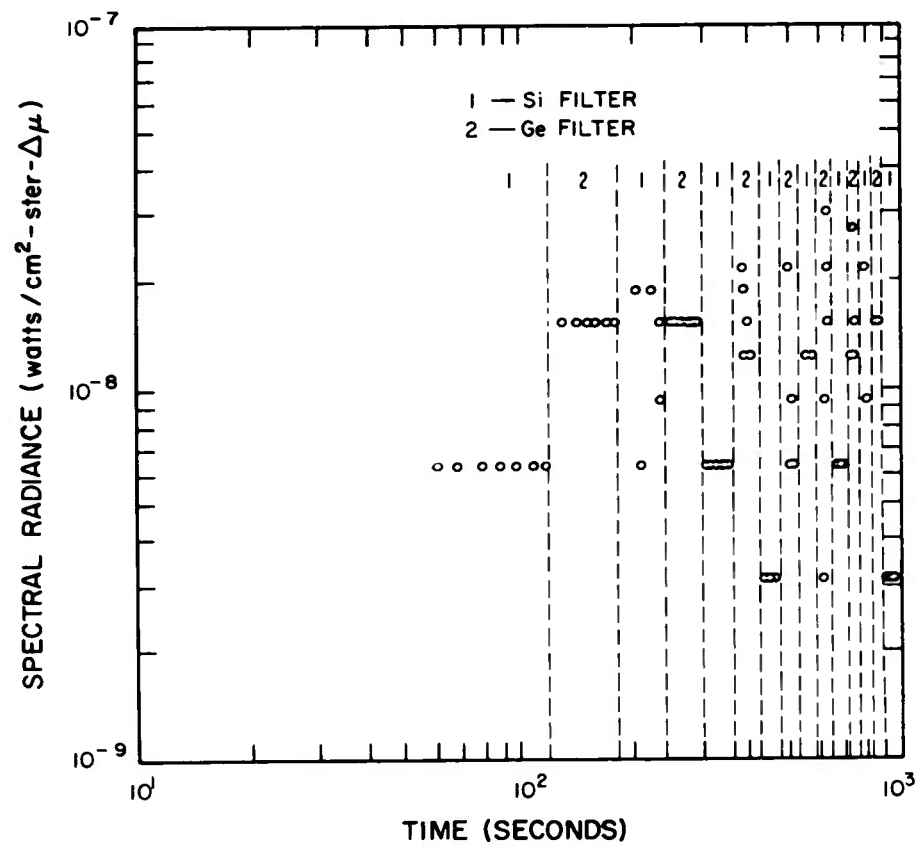


Figure 3.56 Spectral radiance, Kettle II, Star Fish Prime, Channel 9, late time.

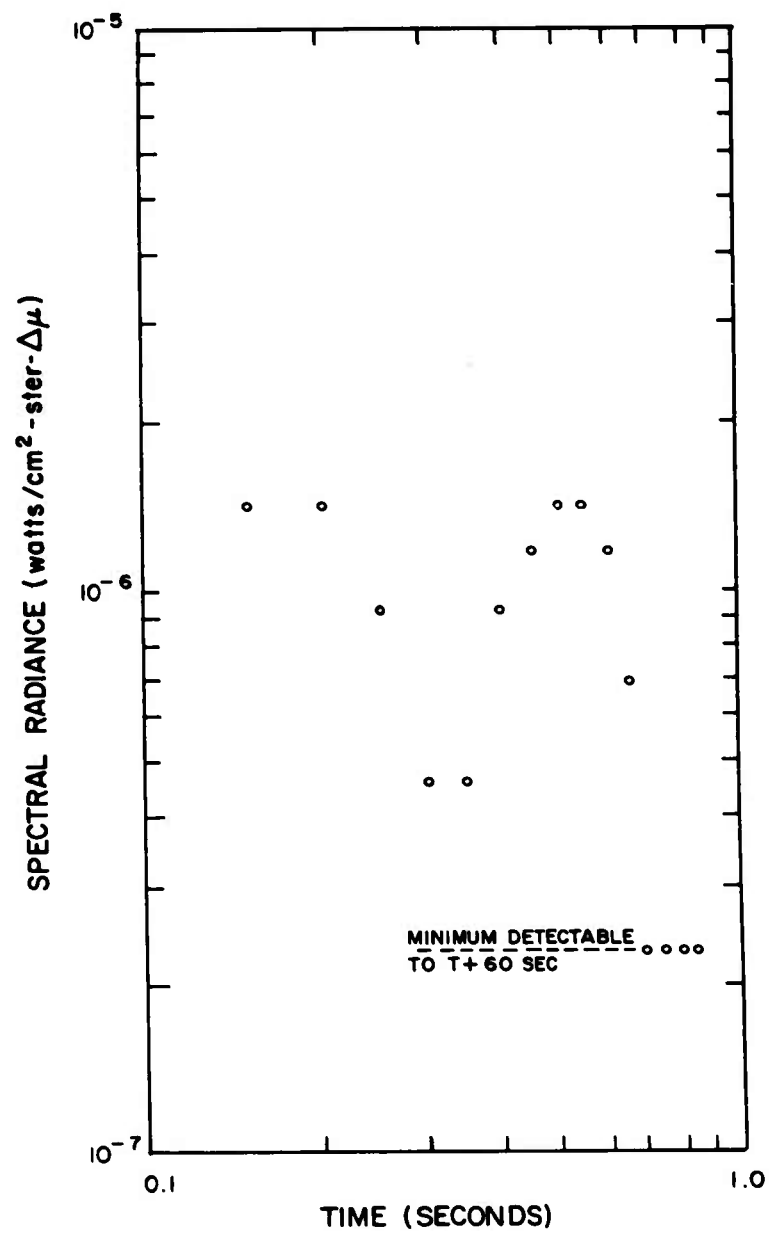


Figure 3.57 Spectral radiance, Kettle II, Star Fish Prime, Channel 10, early time.

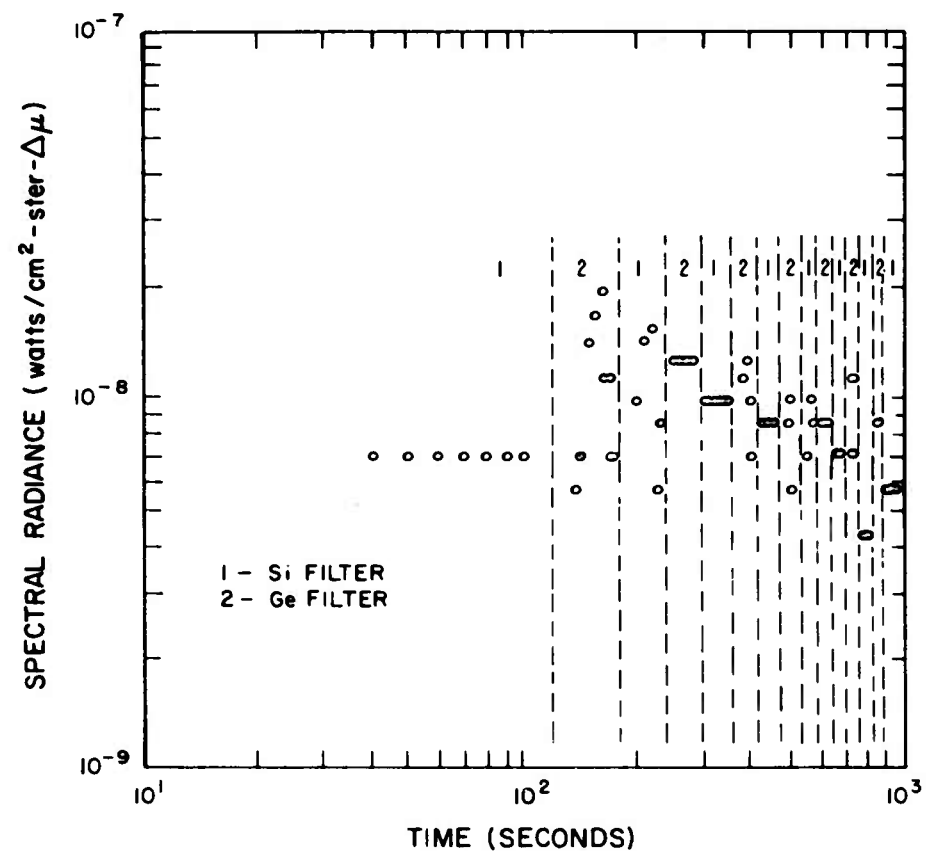


Figure 3.58 Spectral radiance, Kettle II, Star Fish Prime, Channel 10, late time.

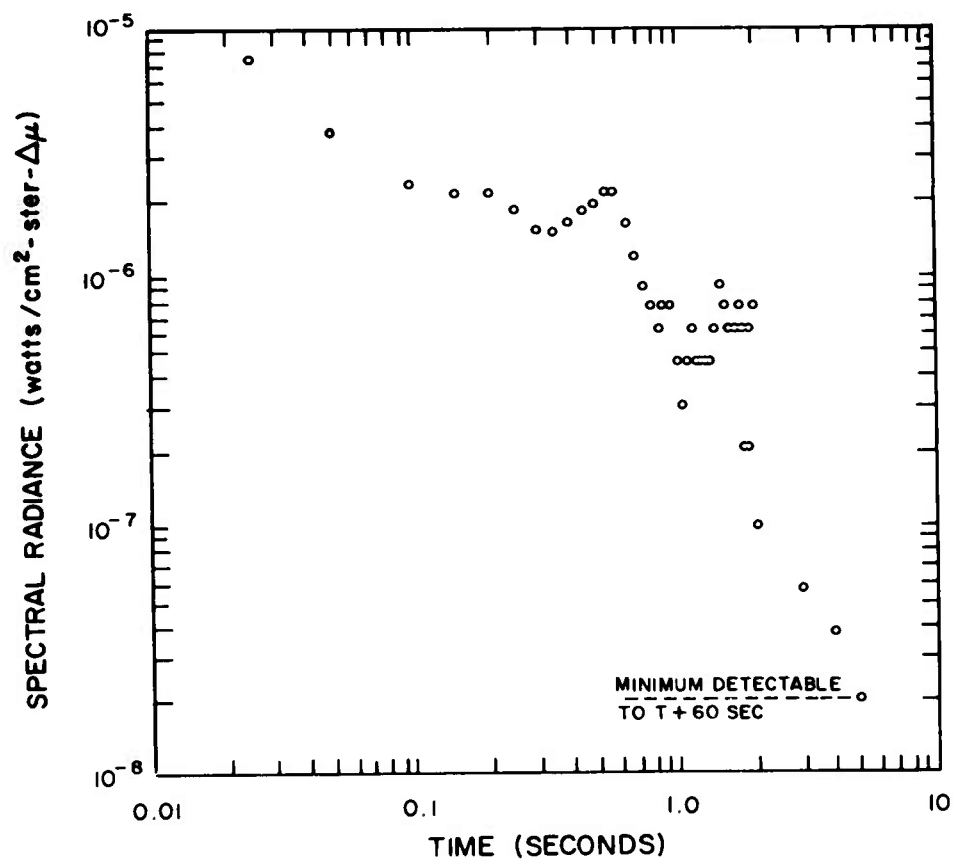


Figure 3.59 Spectral radiance, Kettle II, Star Fish Prime, Channel 11, early time.

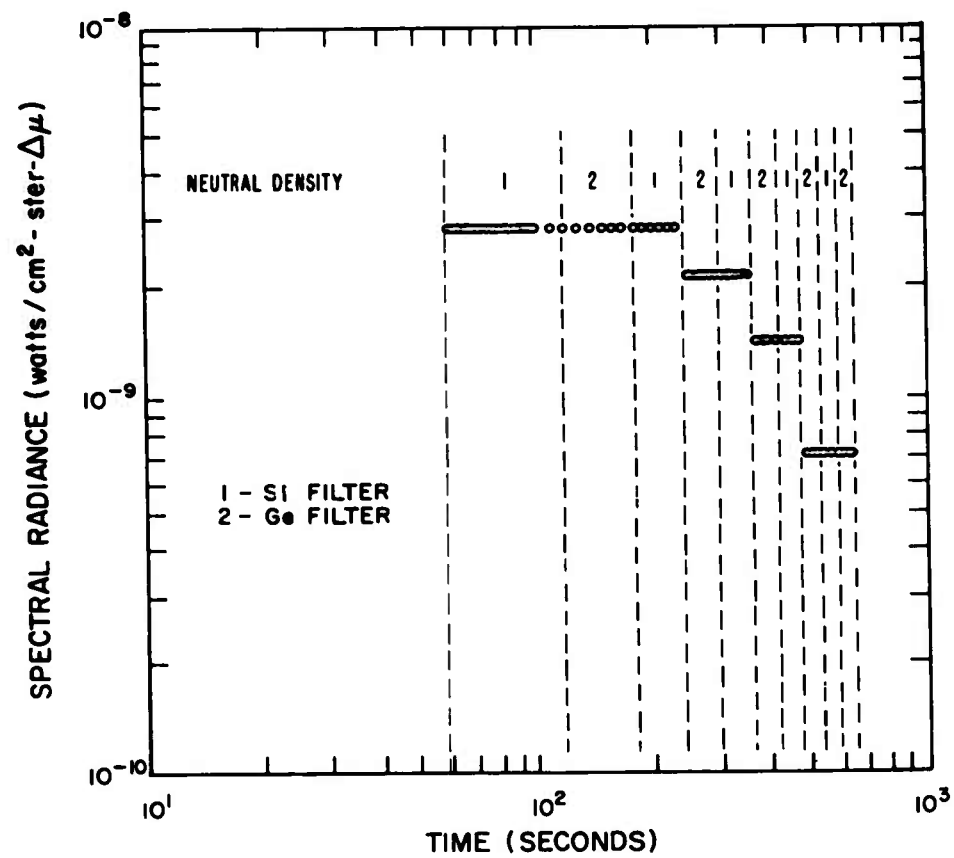


Figure 3.60 Spectral radiance, Kettle II, Star Fish Prime, Channel 11, late time.

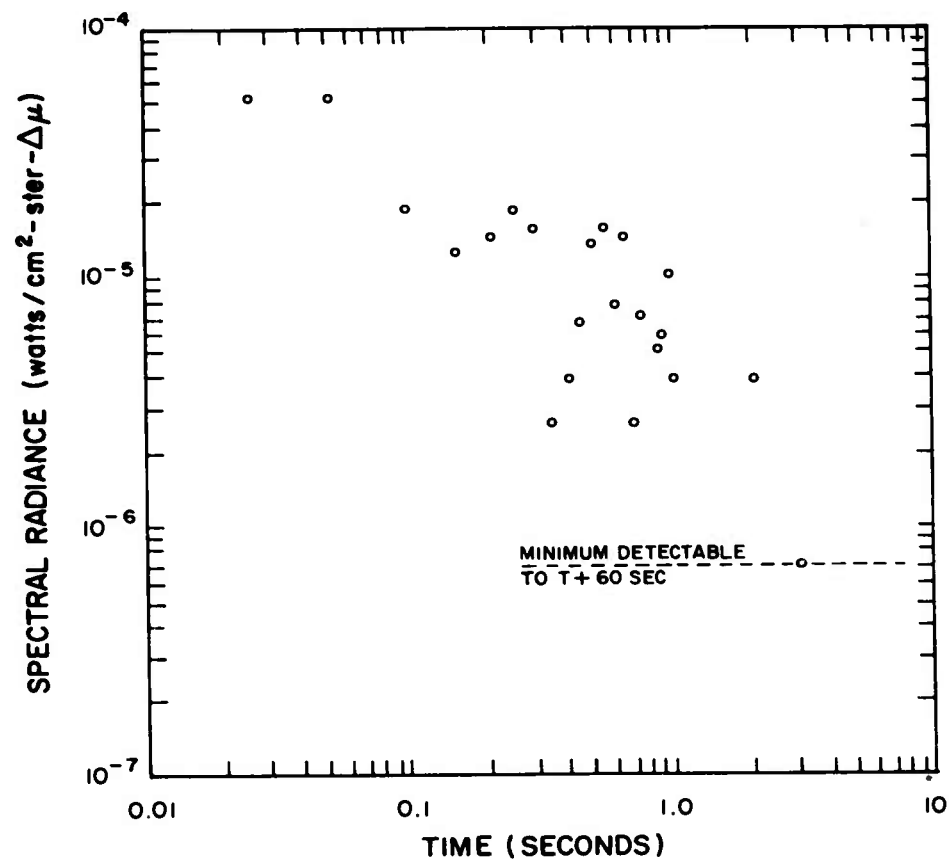


Figure 3.61 Spectral radiance, Kettle II, Star Fish Prime, Channel 12, early time.



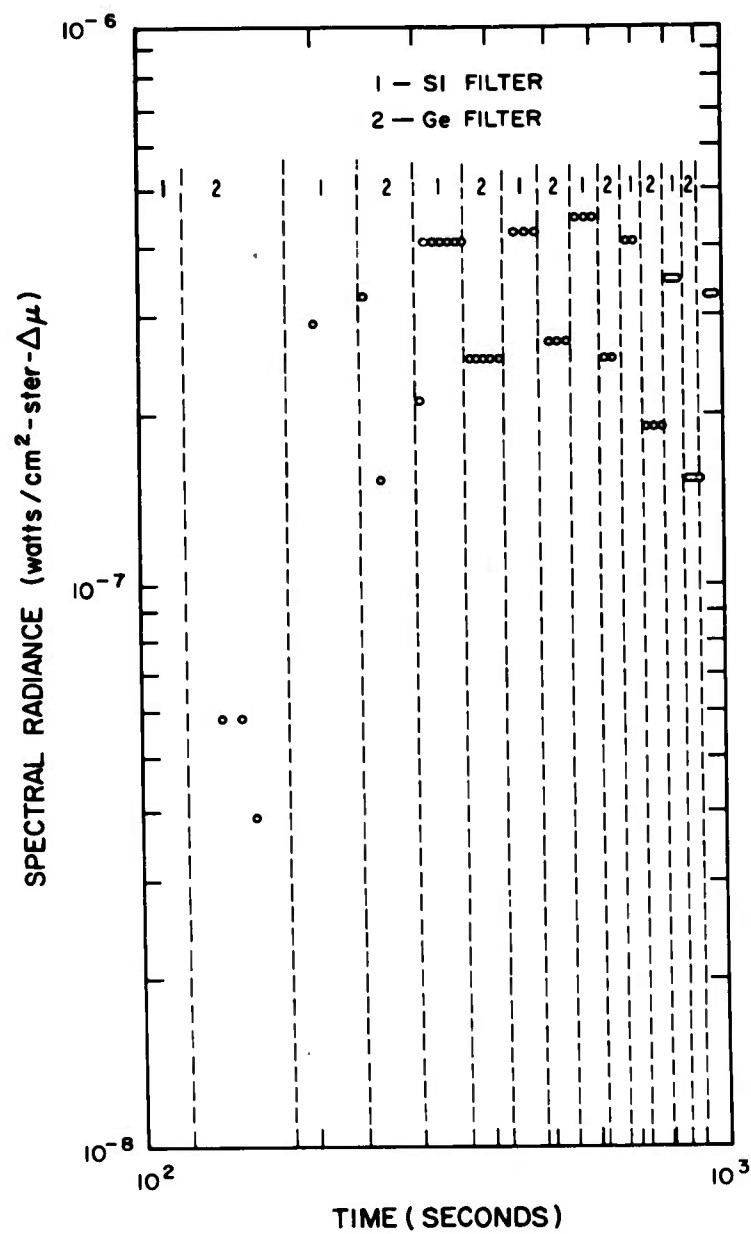


Figure 3.62 Spectral radiance, Kettle II, Star Fish Prime, Channel 12, late time.

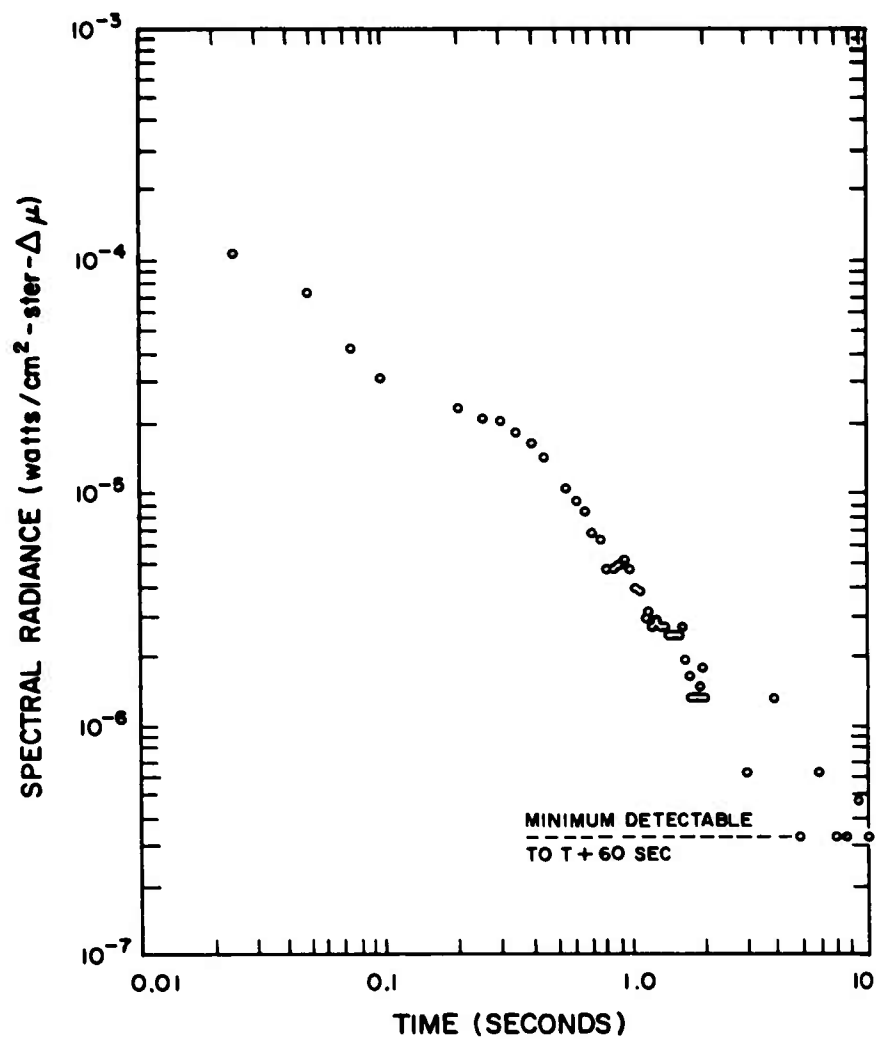


Figure 3.63 Spectral radiance, Kettle II, Star Fish Prime, Channel 14, early time.

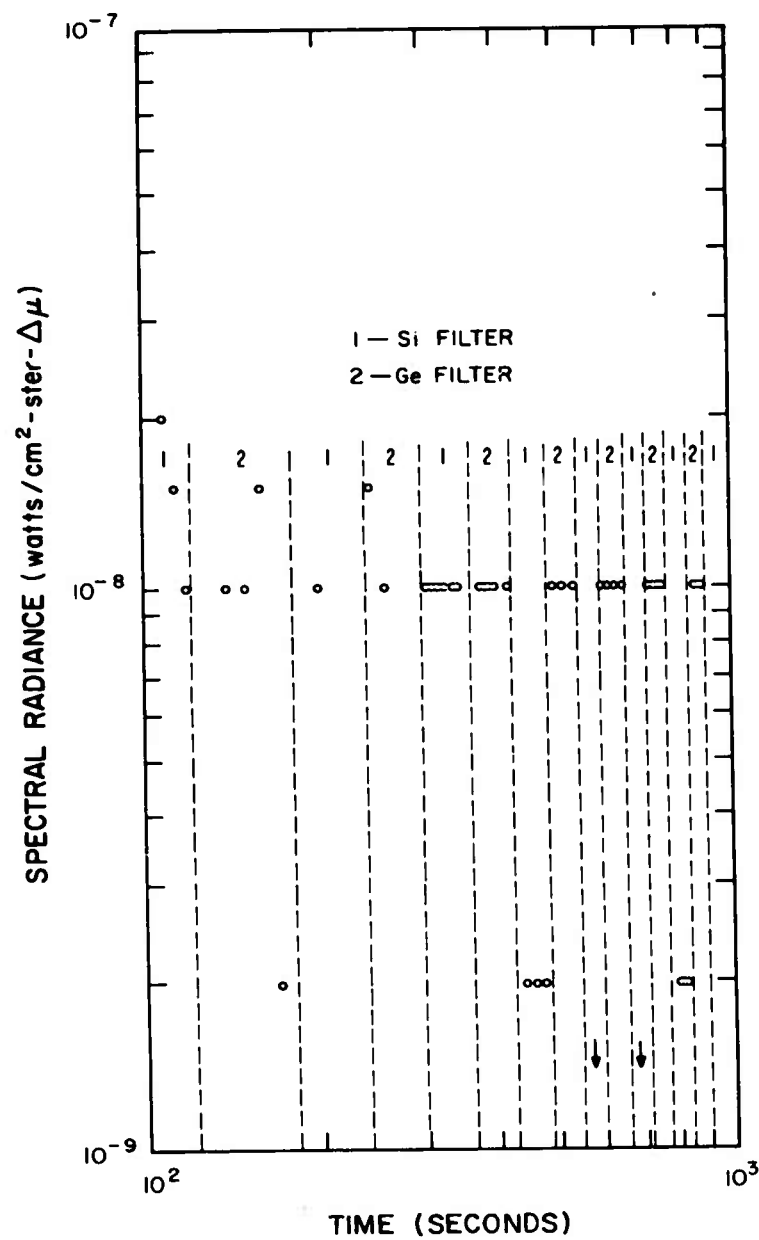


Figure 3.64 Spectral radiance, Kettle II, Star Fish Prime, Channel 14, late time.

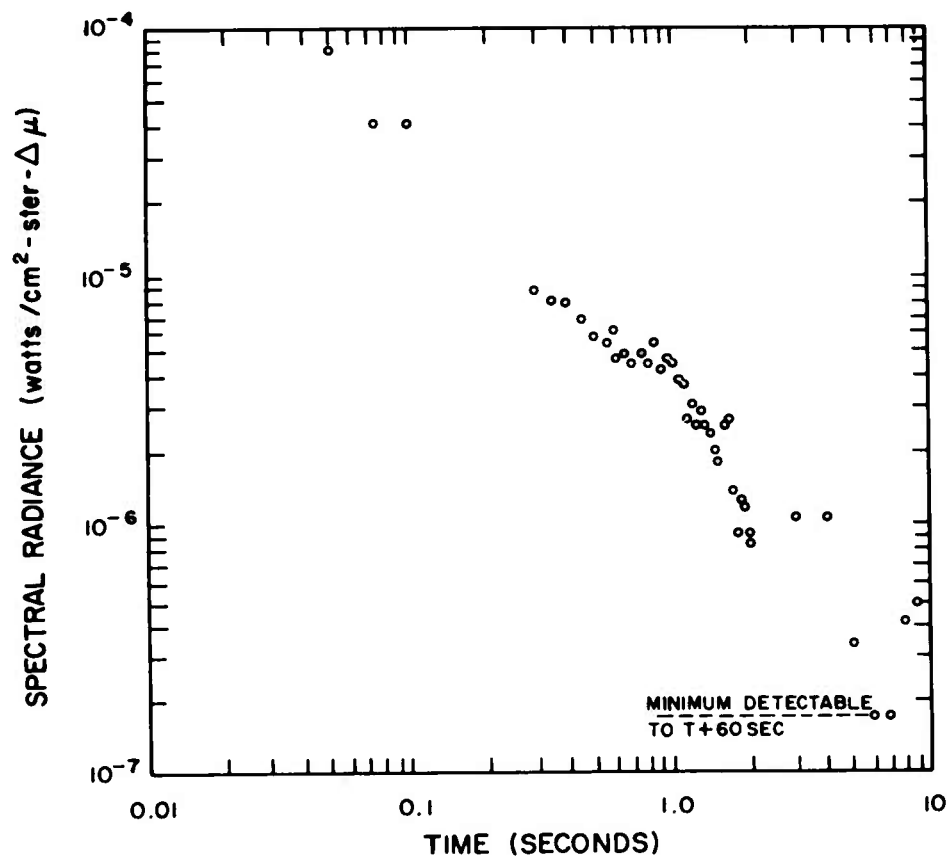


Figure 3.65 Spectral radiance, Kettle II, Star Fish Prime, Channel 15, early time.

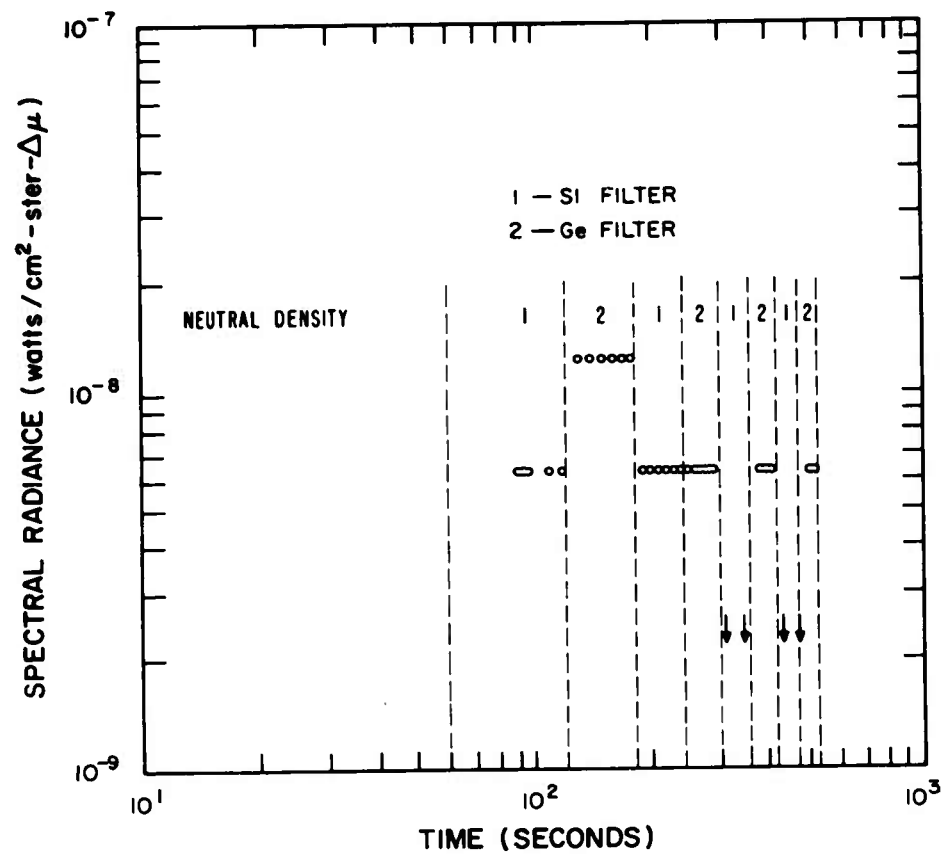


Figure 3.66 Spectral radiance, Kettle II, Star Fish Prime, Channel 15, late time.

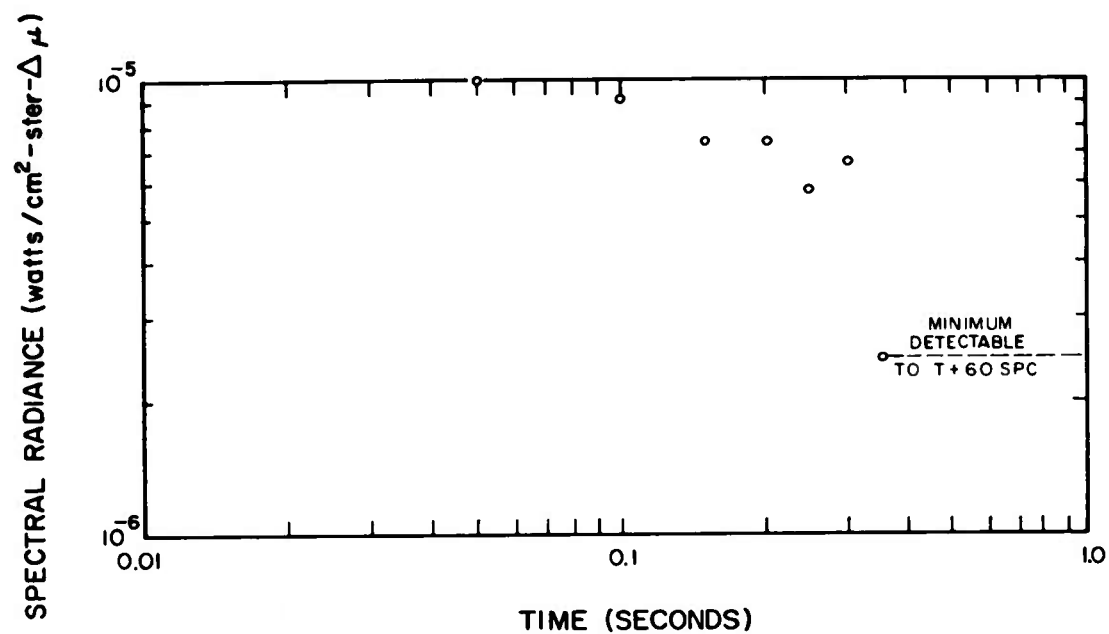


Figure 3.67 Spectral radiance, Kettle II, Star Fish Prime, Channel 16, early time.

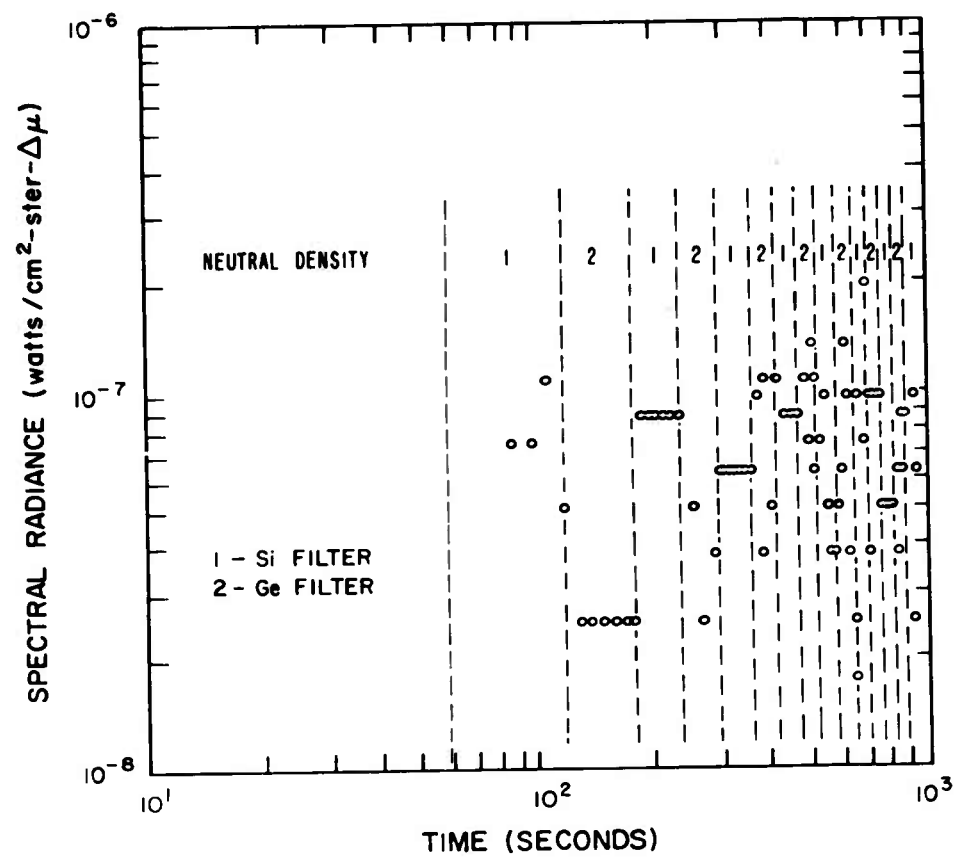


Figure 3.68 Spectral radiance, Kettle II, Star Fish Prime, Channel 16, late time.

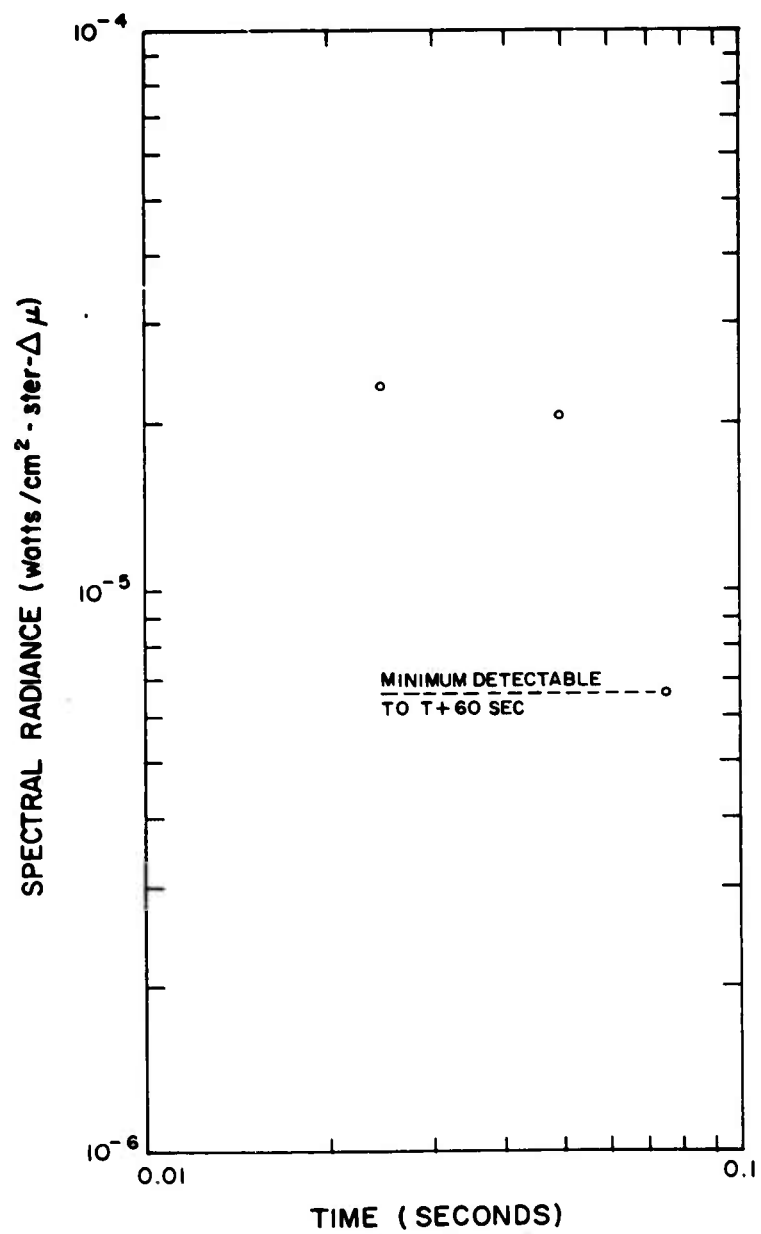


Figure 3.69 Spectral radiance, Kettle II, Star Fish Prime, Channel 17, early time.



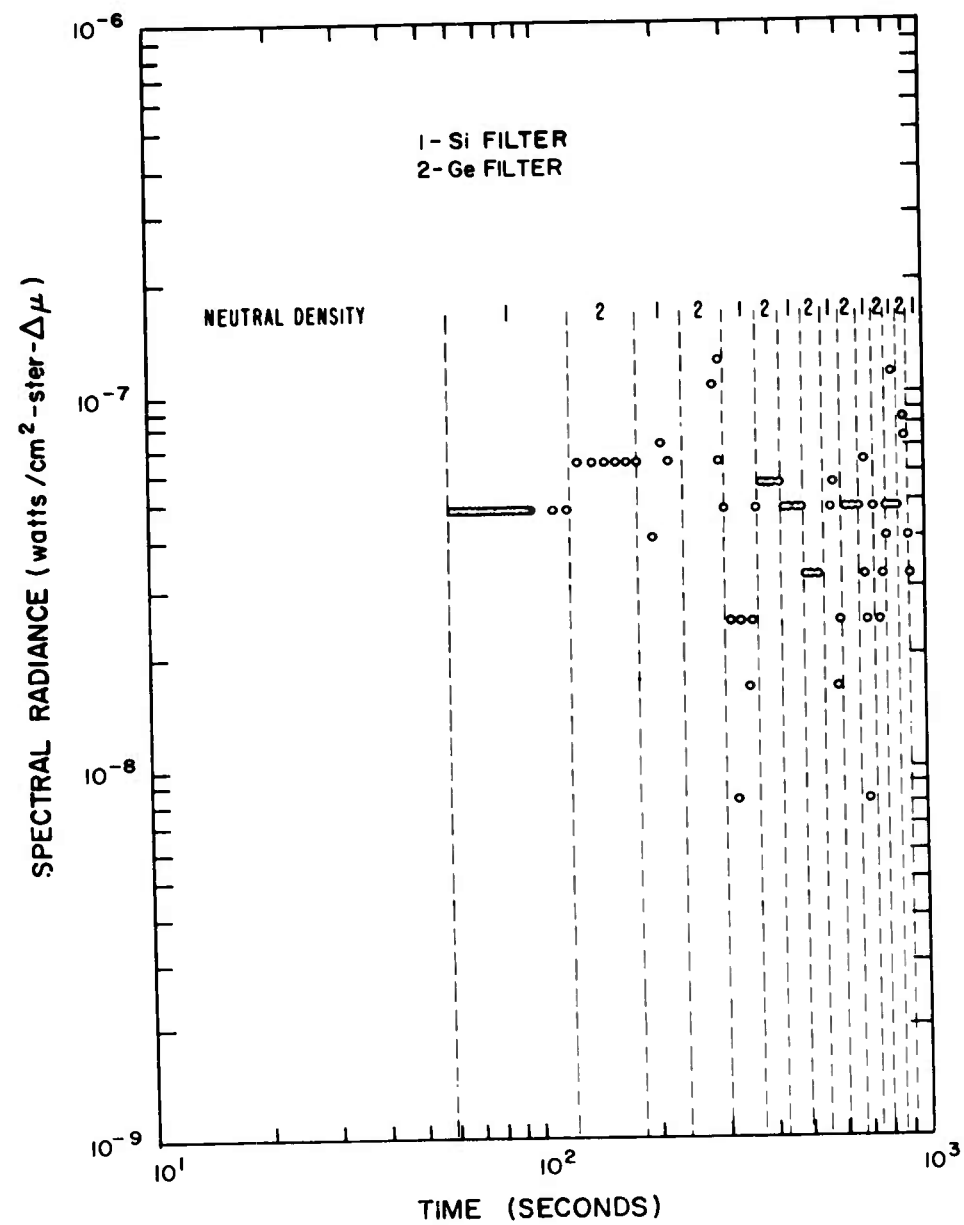
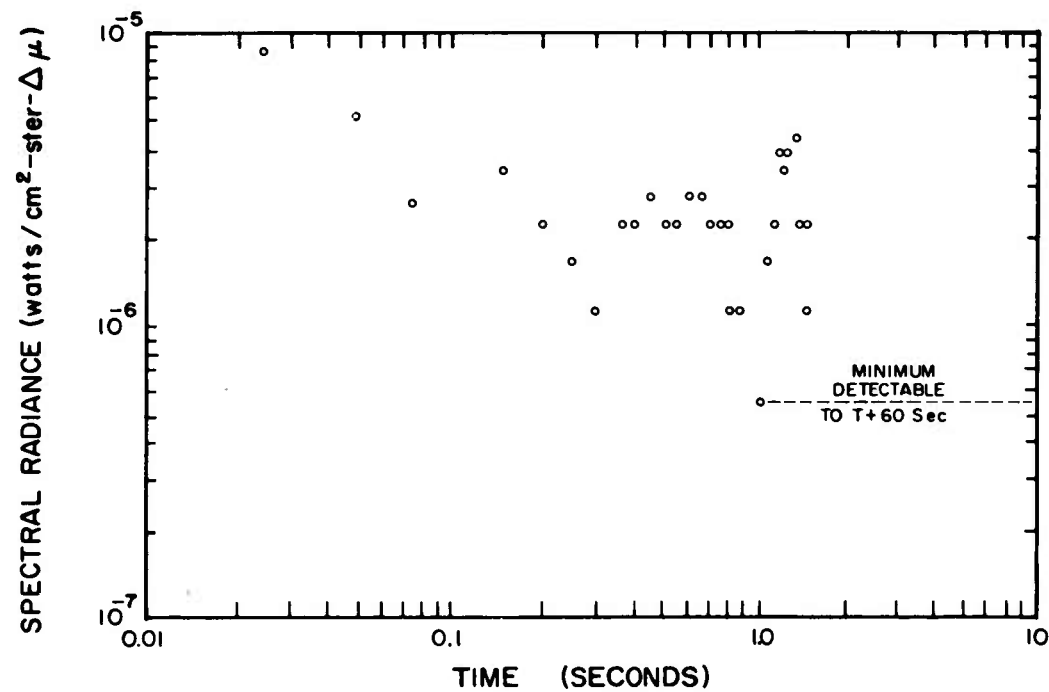


Figure 3.70 Spectral radiance, Kettle II, Star Fish Prime, Channel 17, late time.



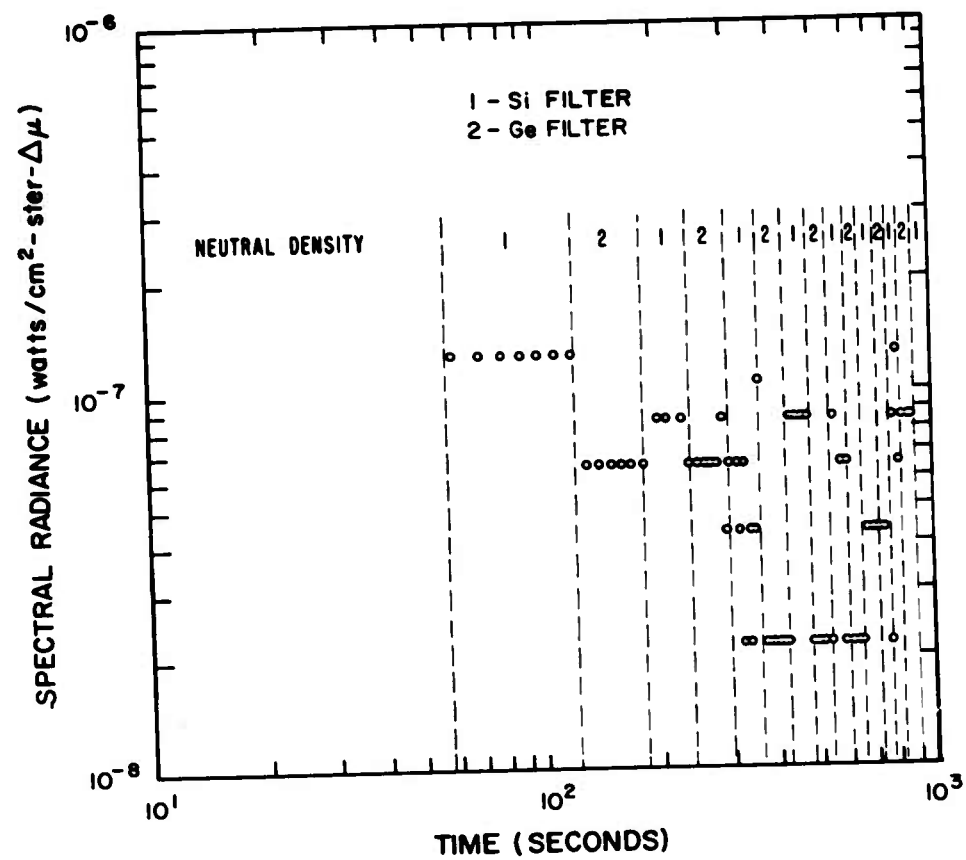


Figure 3.72 Spectral radiance, Kettle II, Star Fish Prime, Channel 18, late time.

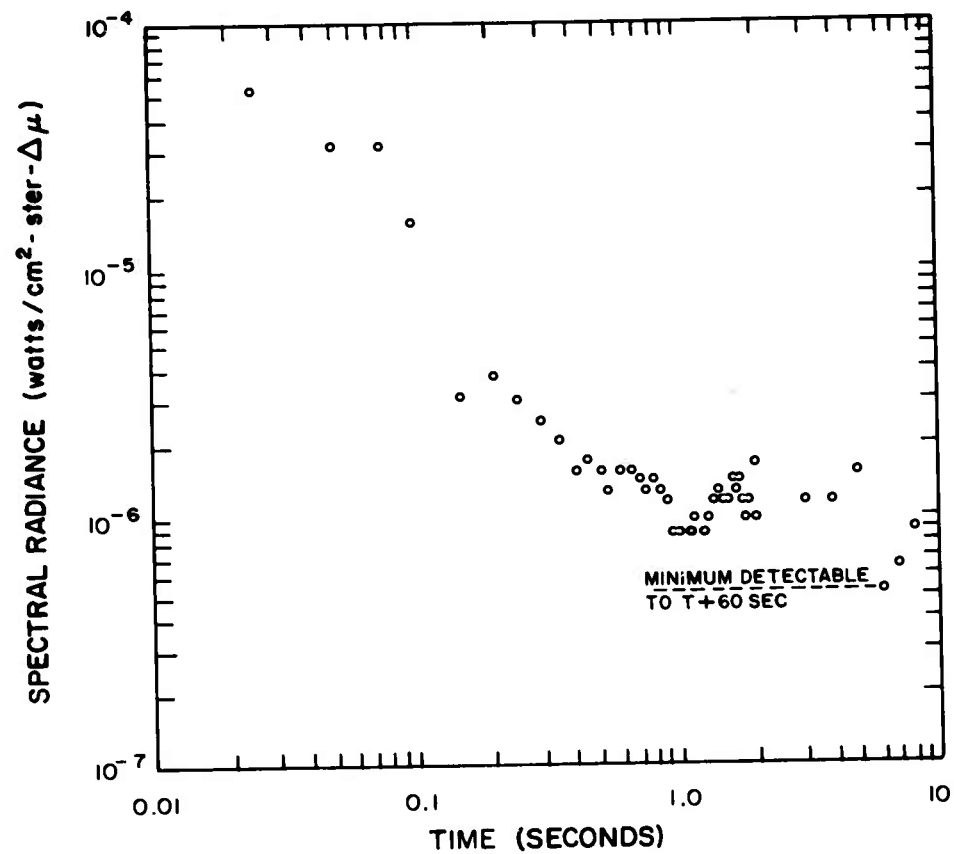


Figure 3.73 Spectral radiance, Kettle II, Star Fish Prime, Channel 20, early time.

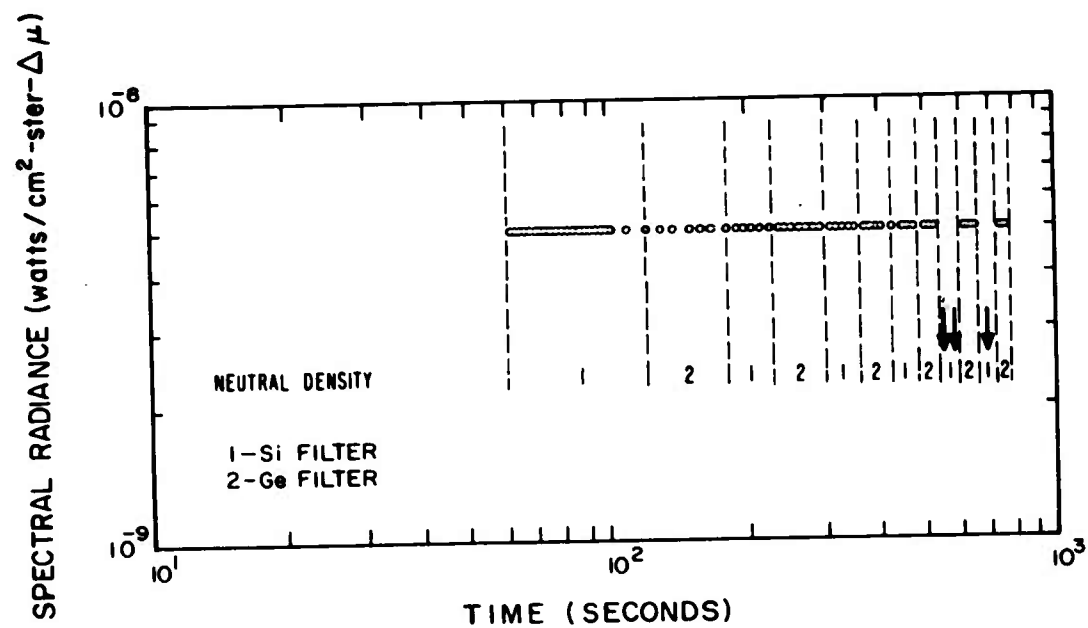


Figure 3.74 Spectral radiance, Kettle II, Star Fish Prime, Channel 20, late time.

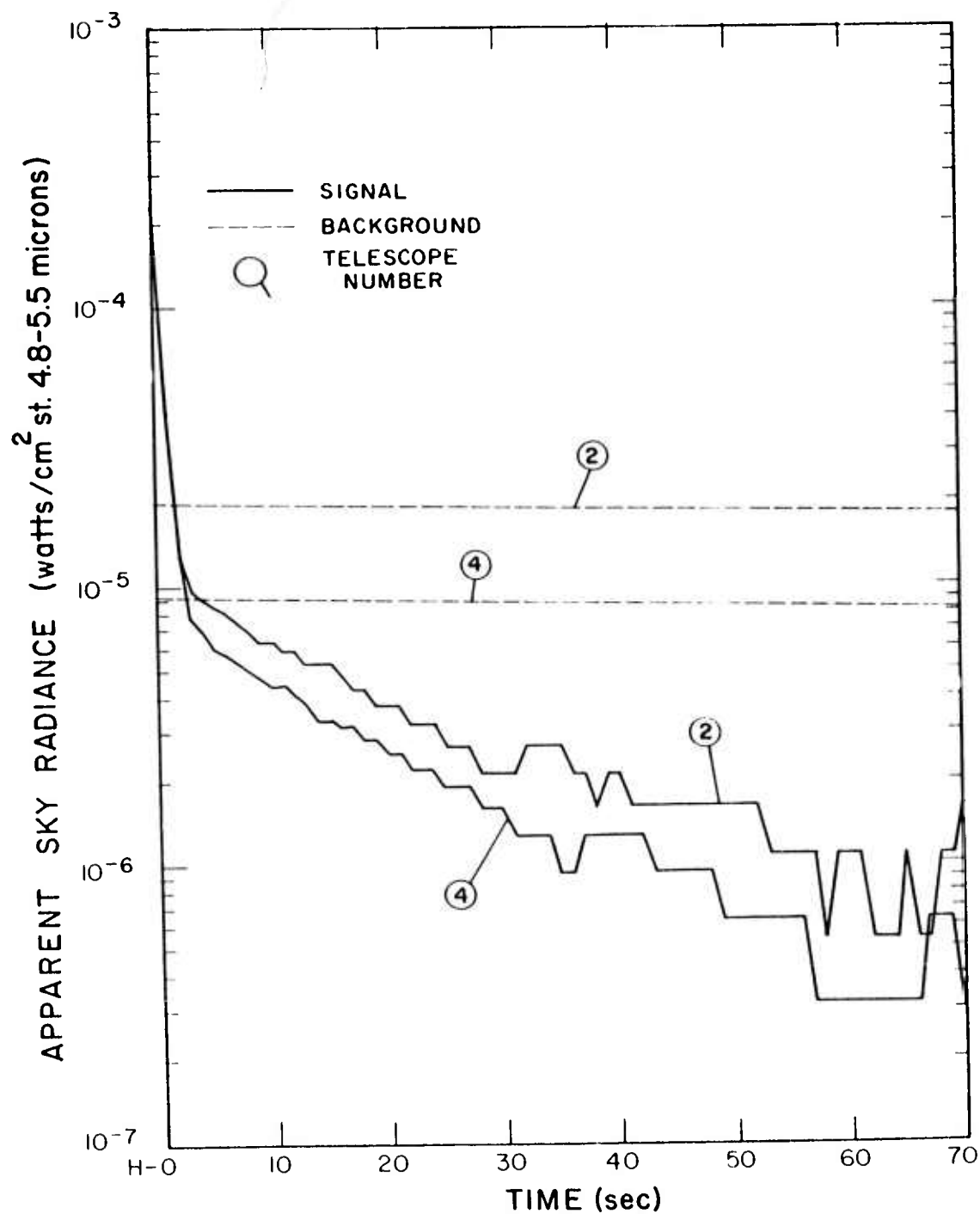


Figure 3.75 5.0-micron data, Star Fish Prime.

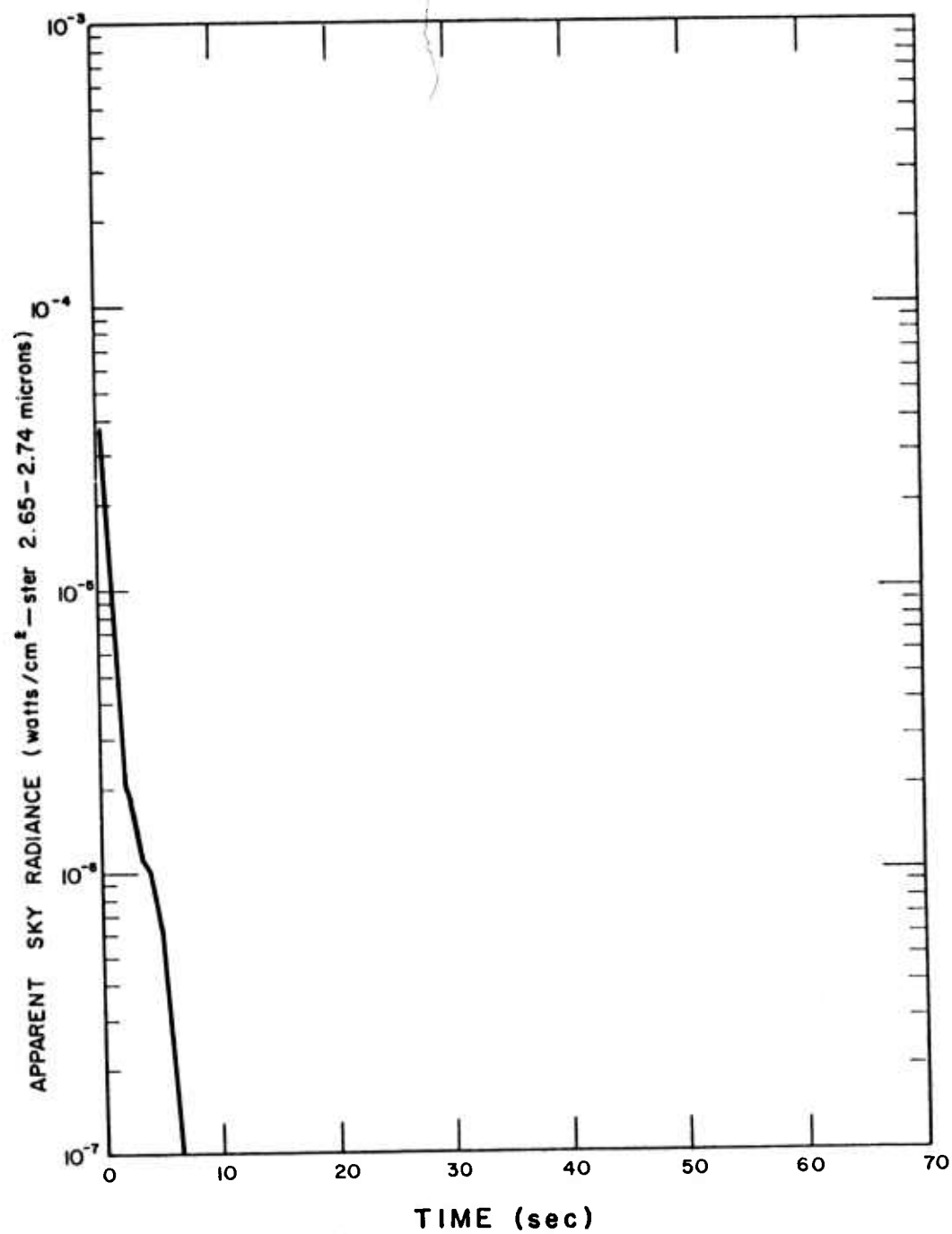


Figure 3.76 2.7-micron data, Kettle I, Star Fish Prime.

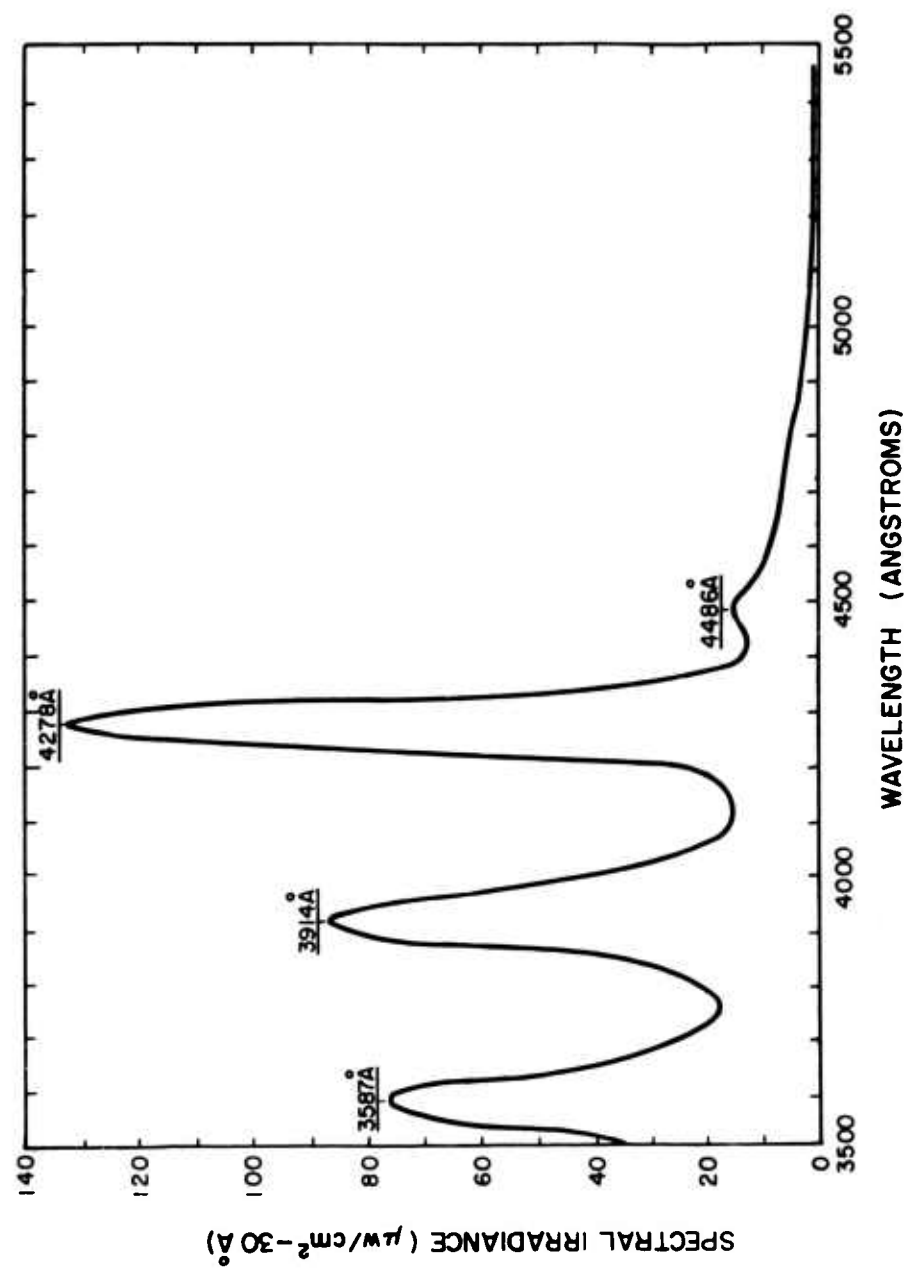


Figure 3.77 Spectrogram at H + 2 msec, Kettle II, Star Fish Prime.



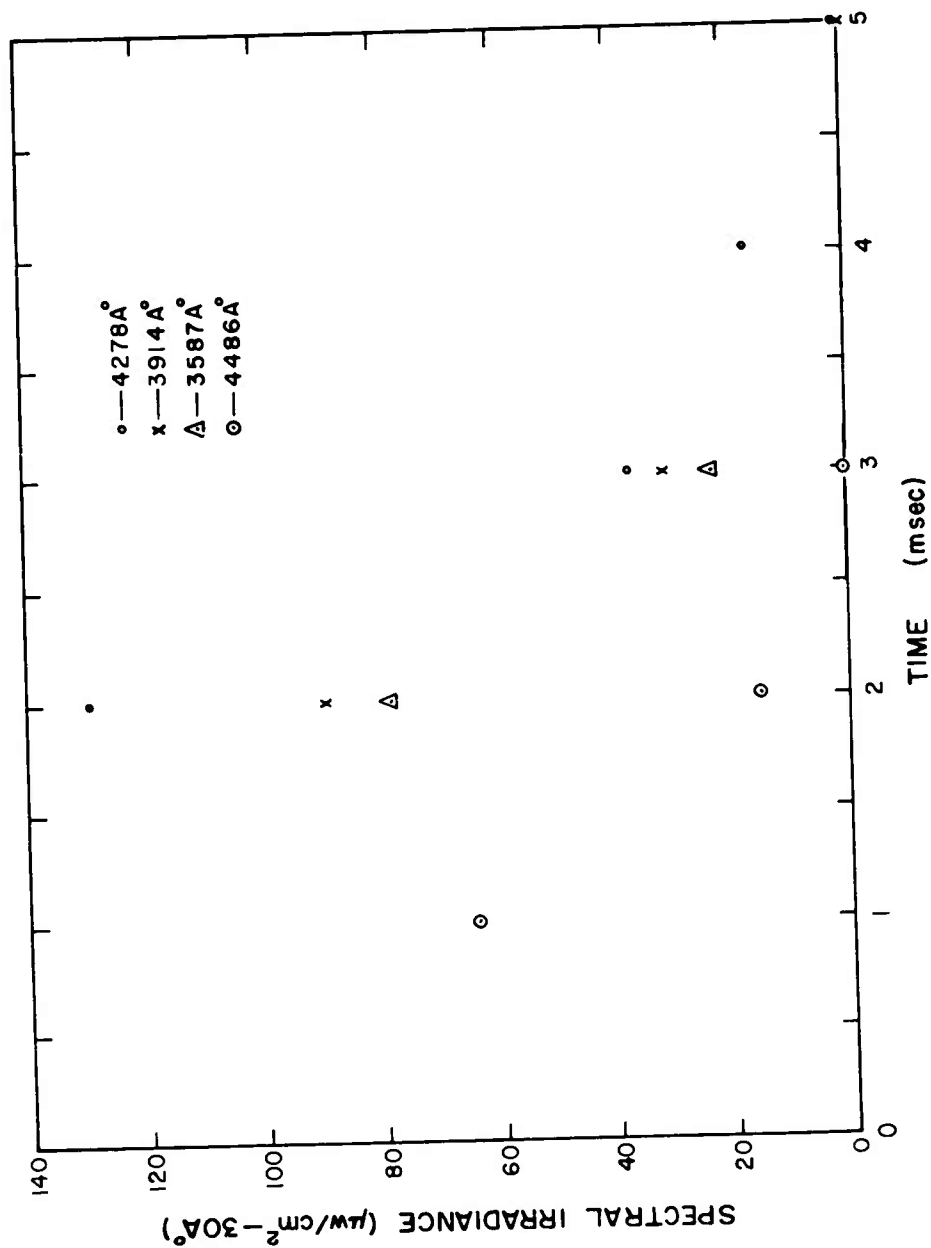


Figure 3.78 Decay of spectral irradiance at four wavelengths, Kettle II, Star Fish Prime.

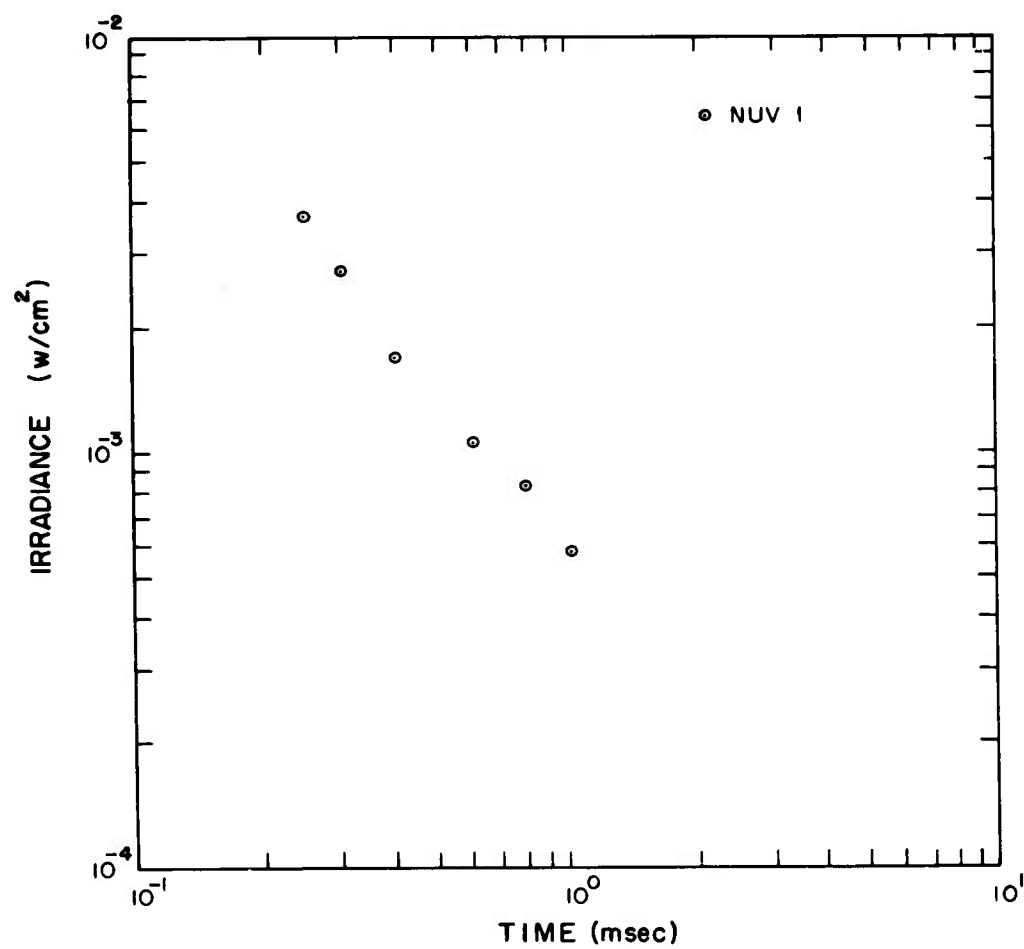


Figure 3.79 Irradiance, Kettle I, Star Fish Prime, in spectral region 0.29 to 0.40  $\mu$ .

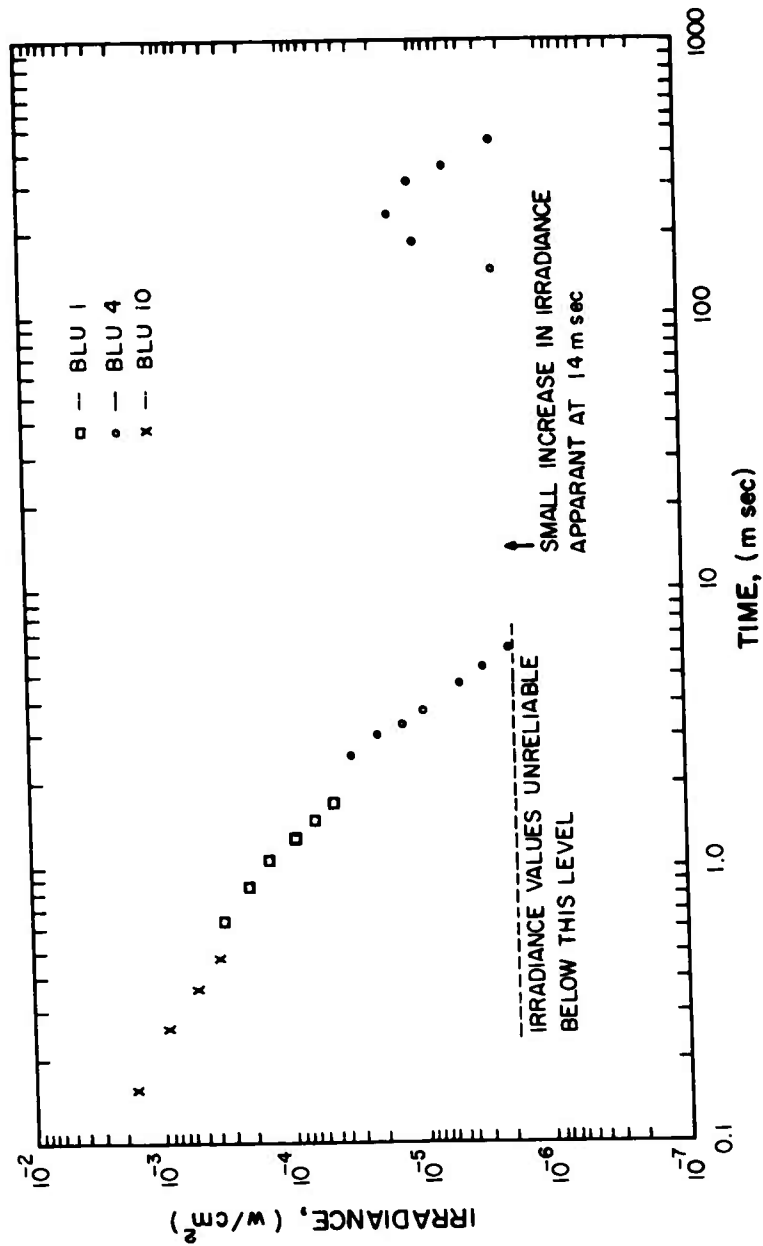


Figure 3.80 Irradiance, Kettle I, Star Fish Prime, in spectral region 0.40 to 0.50  $\mu$ .

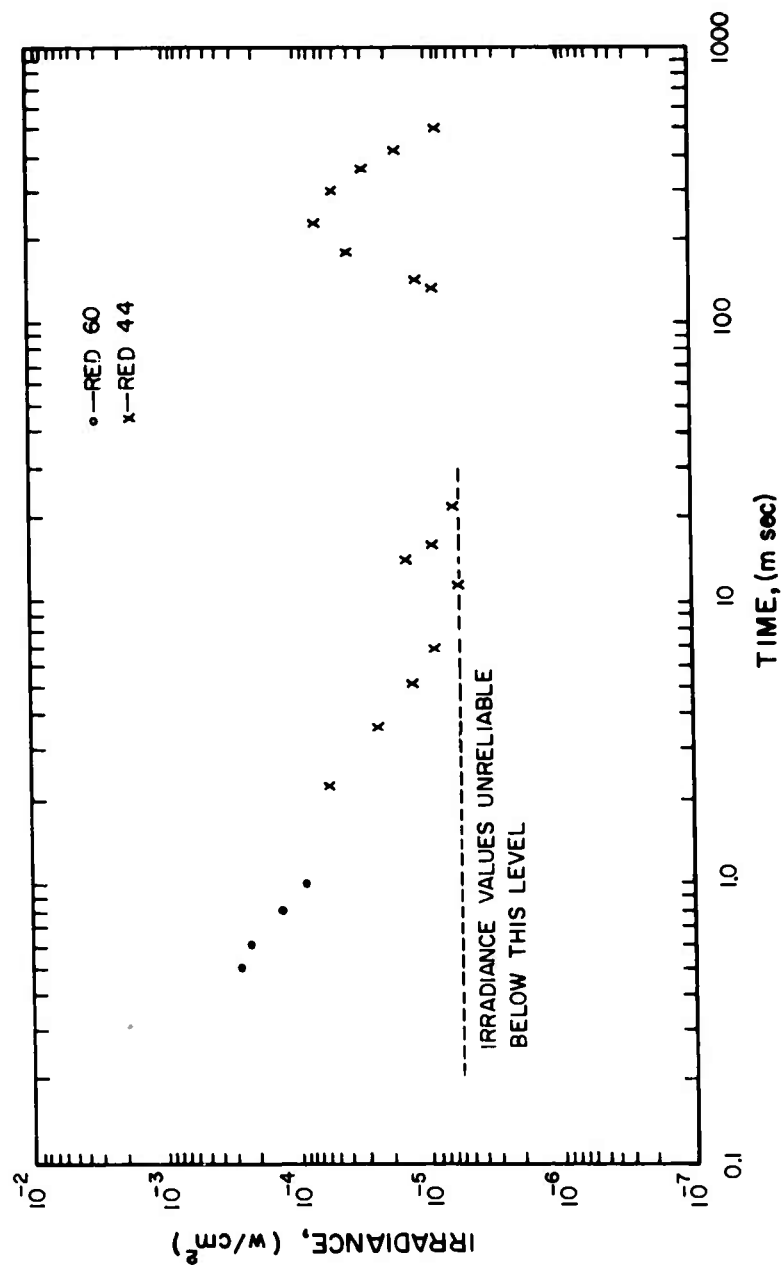


Figure 3.81 Irradiance, Kettle I, Star Fish Prime, in spectral region 0.50 to 0.75  $\mu$ .

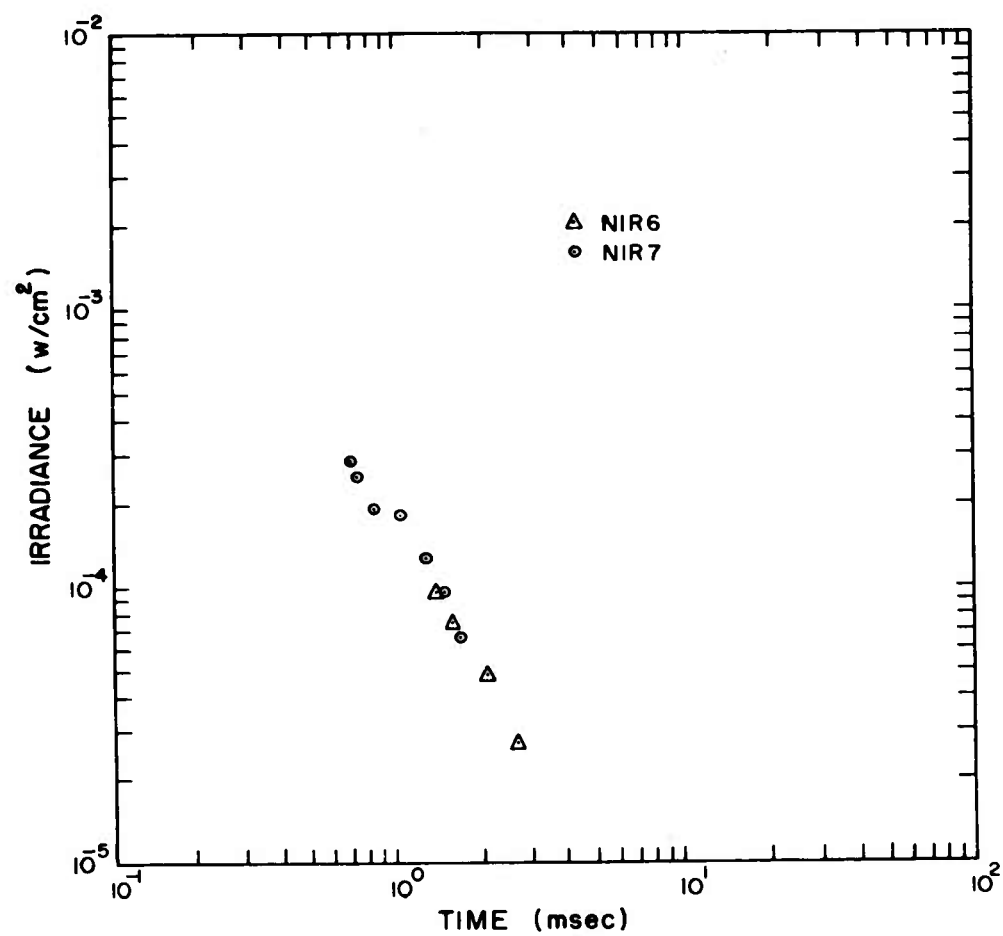


Figure 3.82 Irradiance, Kettle I, Star Fish Prime, in spectral region 0.75 to 1.0  $\mu$ .

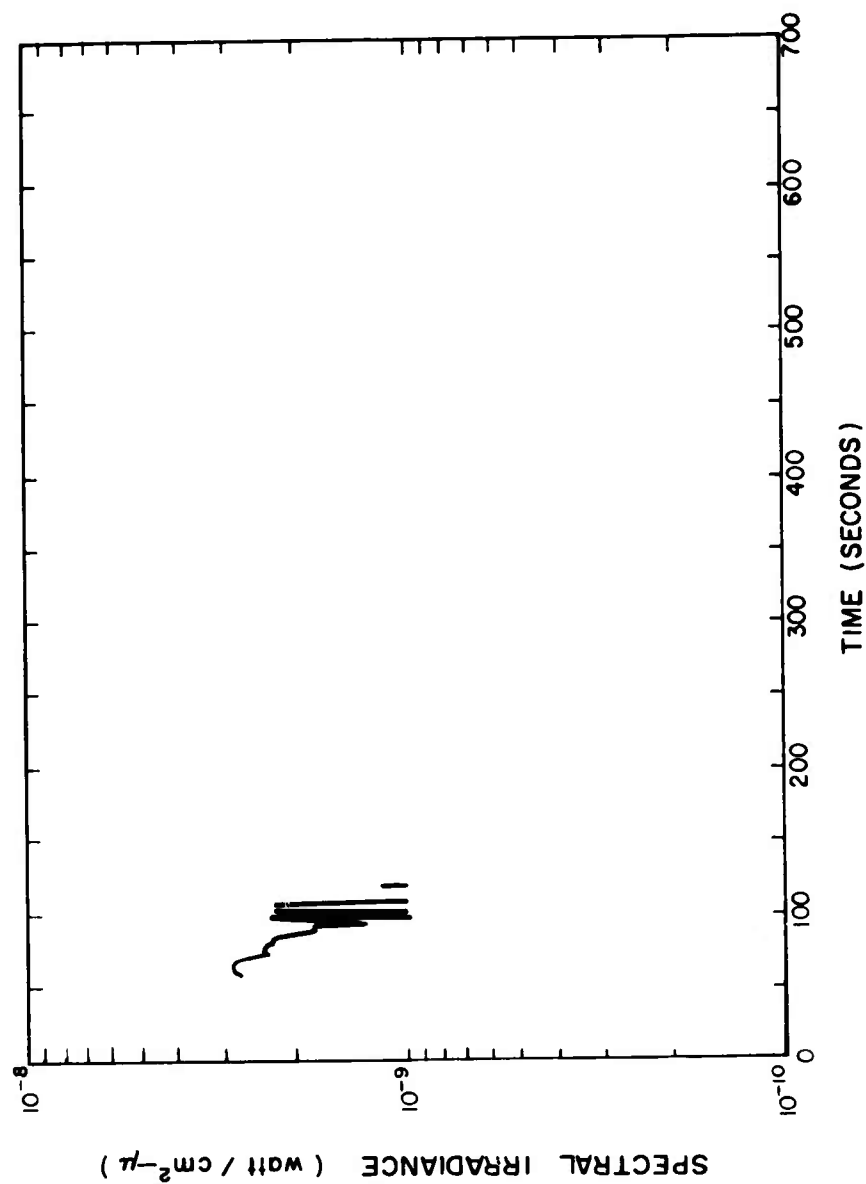


Figure 3.83 Irradiance, Kettle I, Star Fish Prime, in spectral region 1.565 to 1.62  $\mu$ .

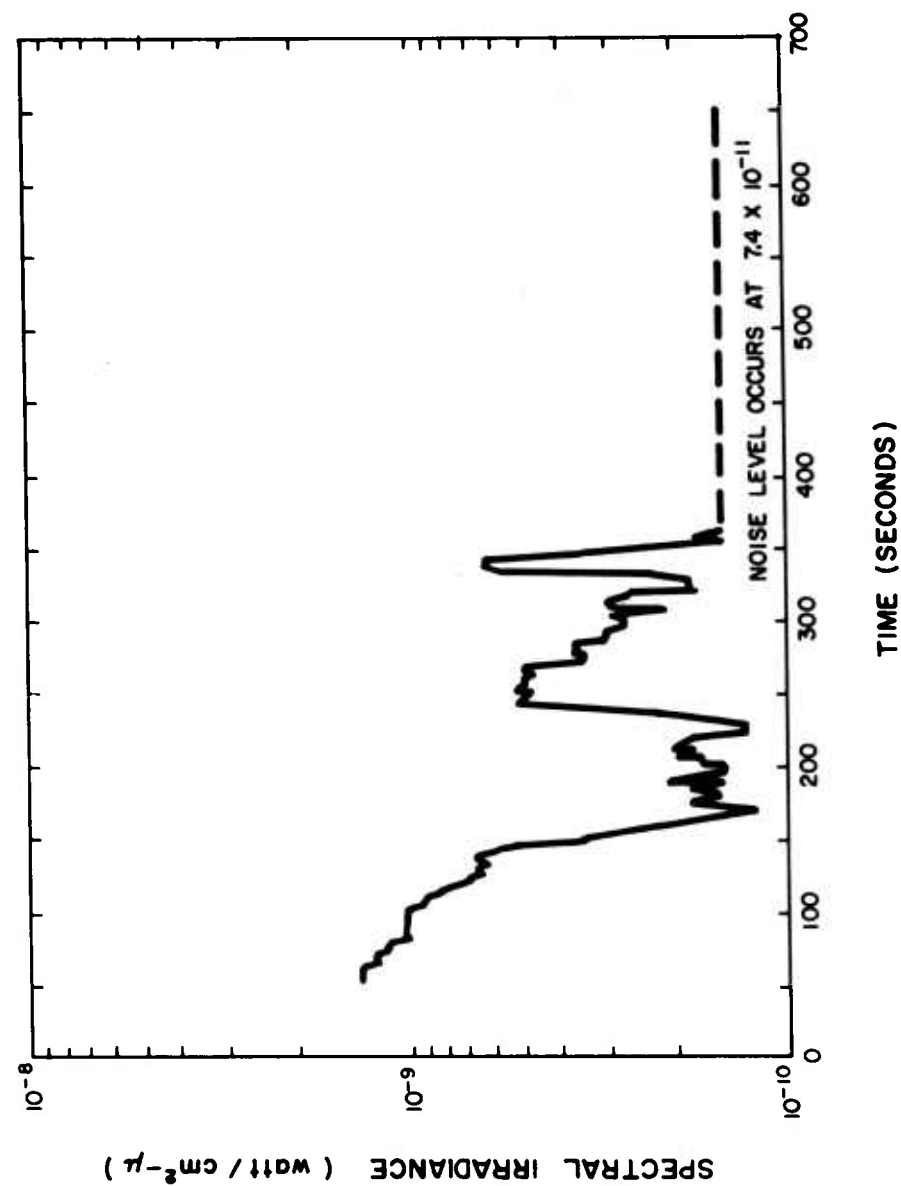


Figure 3.84 Irradiance, Kettle I, Star Fish Prime, in spectral region 1.63 to 1.92 μ.

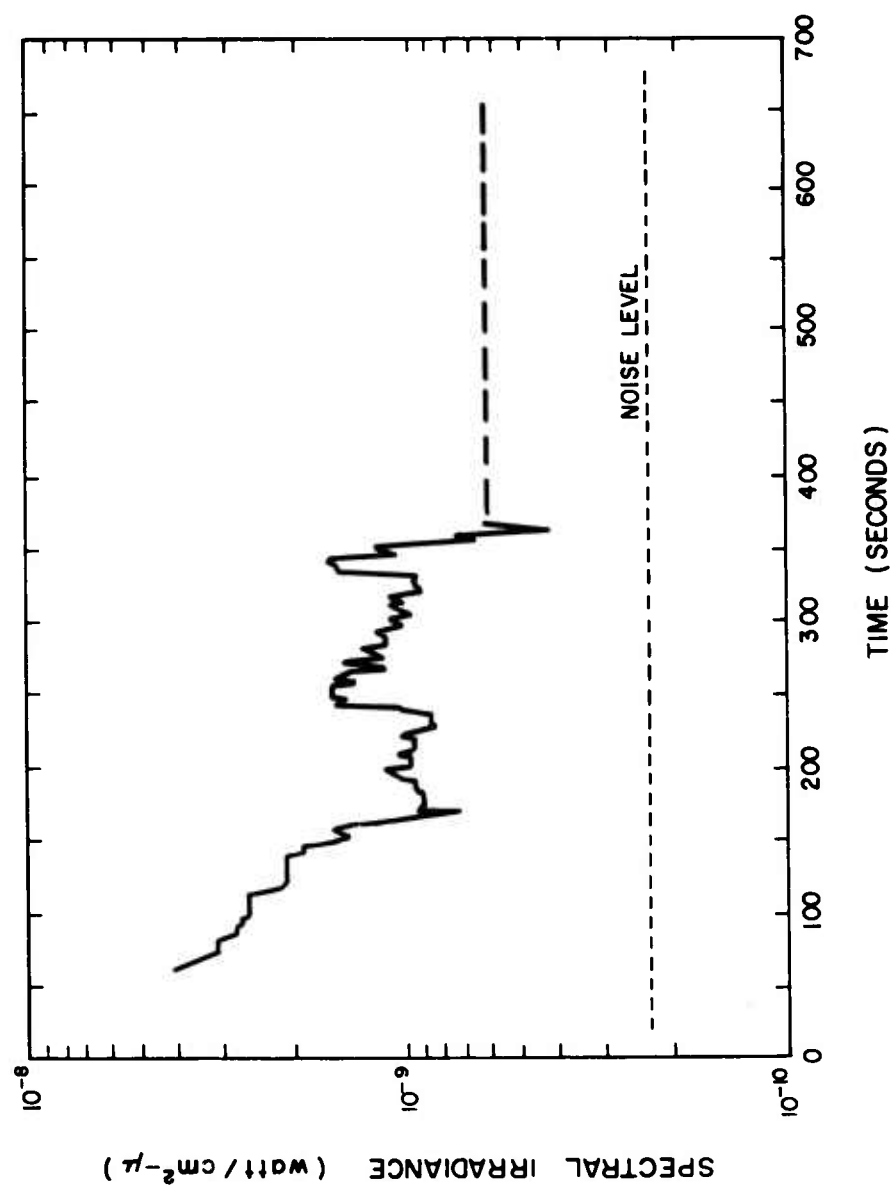


Figure 3.85 Irradiance, Kettle I, Star Fish Prime, in spectral region 1.91 to 2.55  $\mu$ .



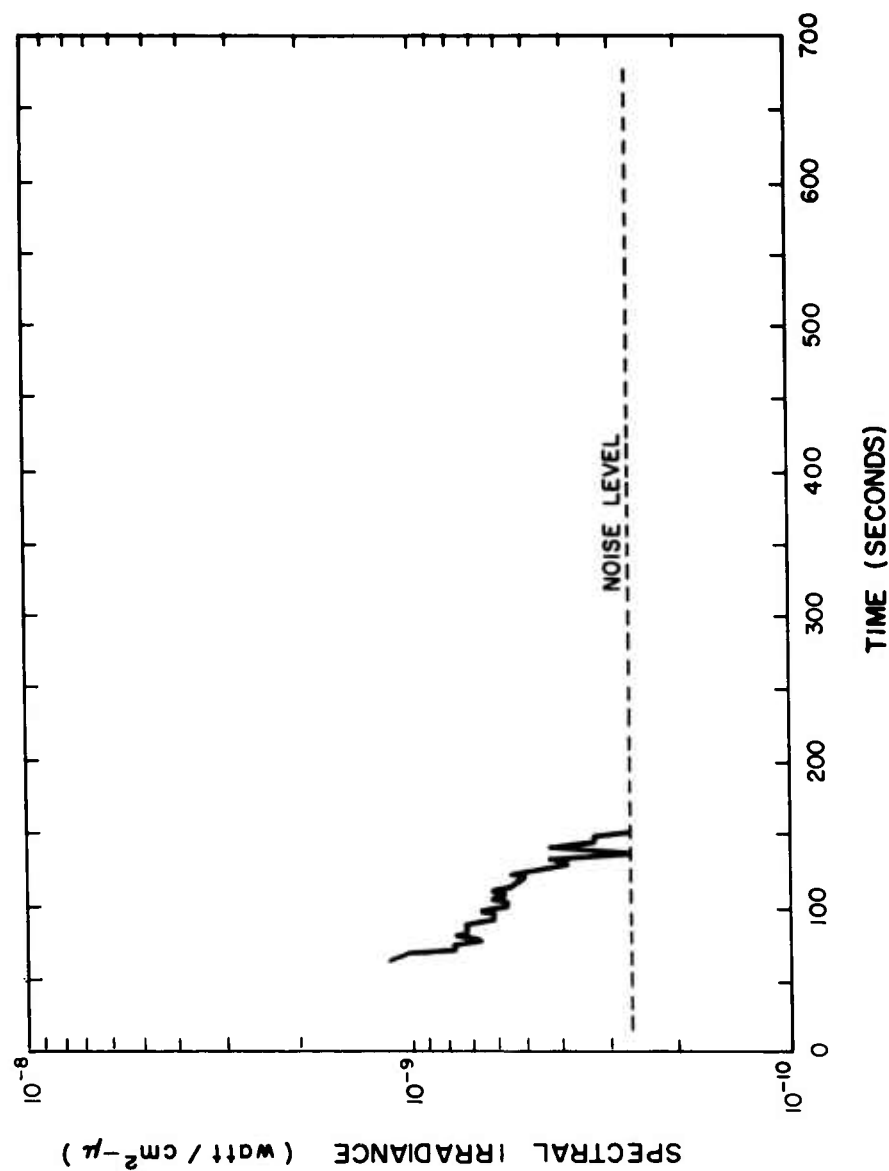


Figure 3.86 Irradiance, Kettle I, Star Fish Prime, in spectral region 2.15 to 2.21 μ.

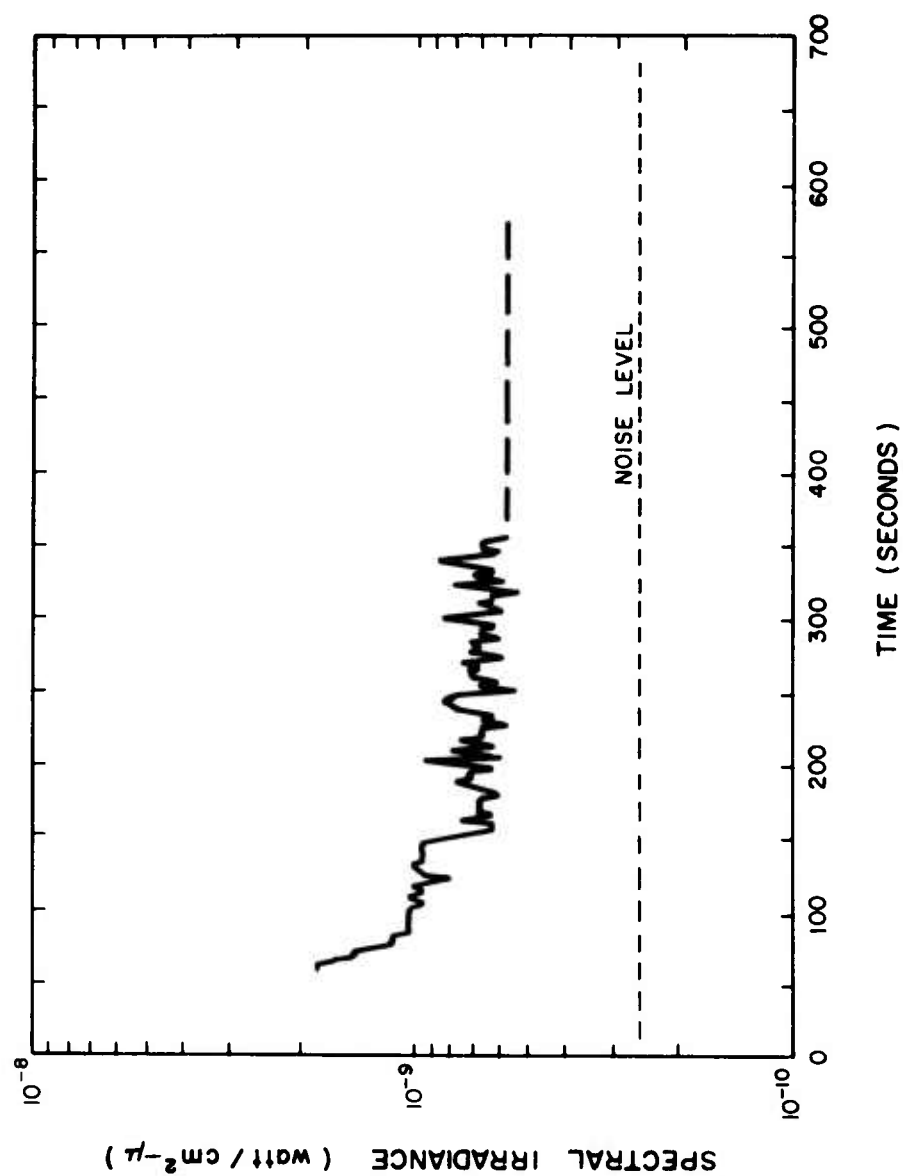


Figure 3.87 Irradiance, Kettle I, Star Fish Prime, in spectral region 2.63 to 2.73  $\mu$ .

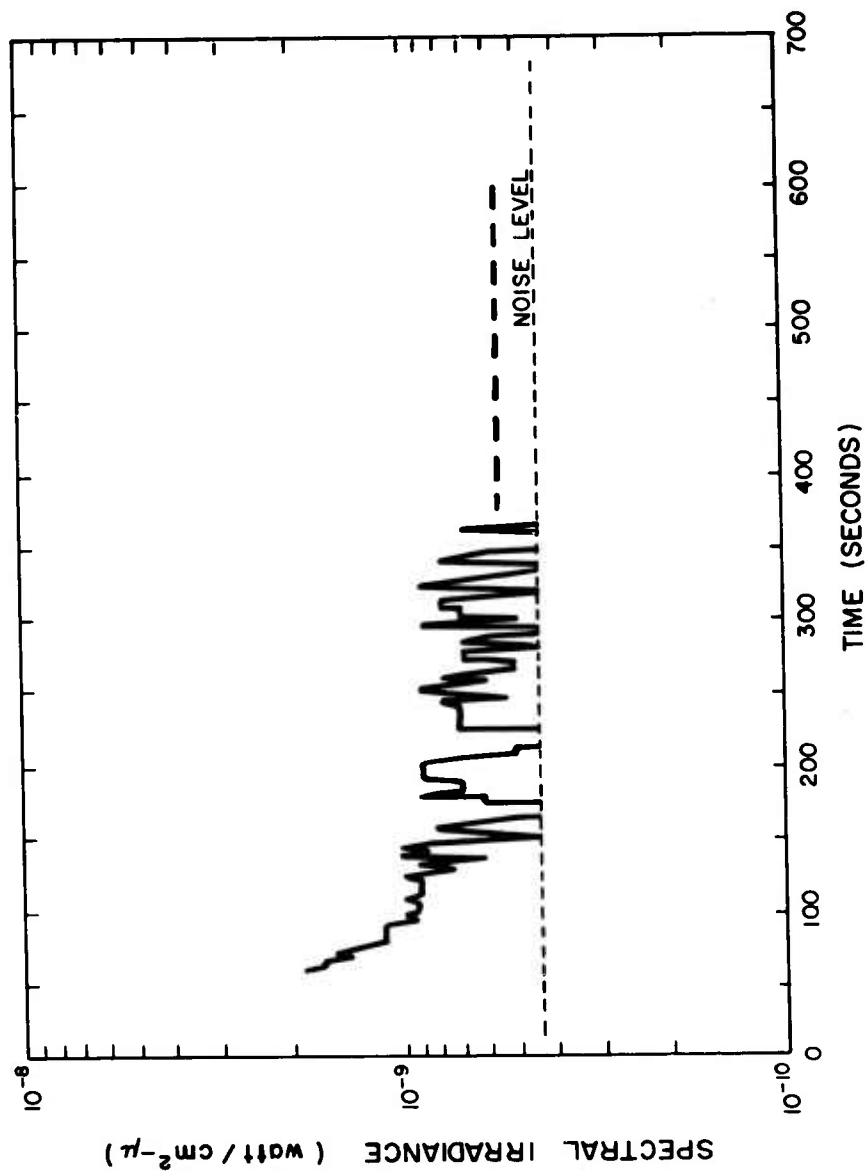


Figure 3.88 Irradiance, Kettle I, Star Fish Prime, in spectral region 2.64 to 2.71  $\mu$ .

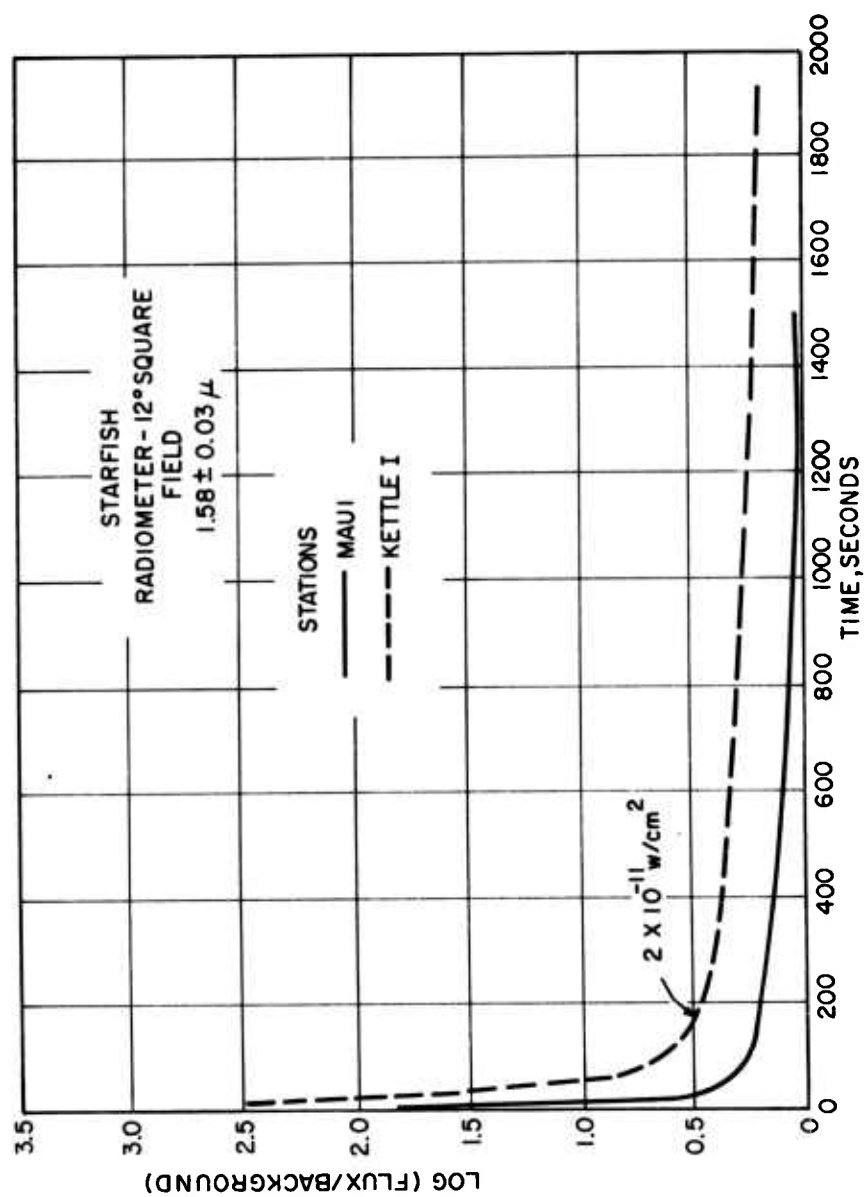


Figure 3.89 PbS radiometer data, Maui and Kettle I, Star Fish Prime.

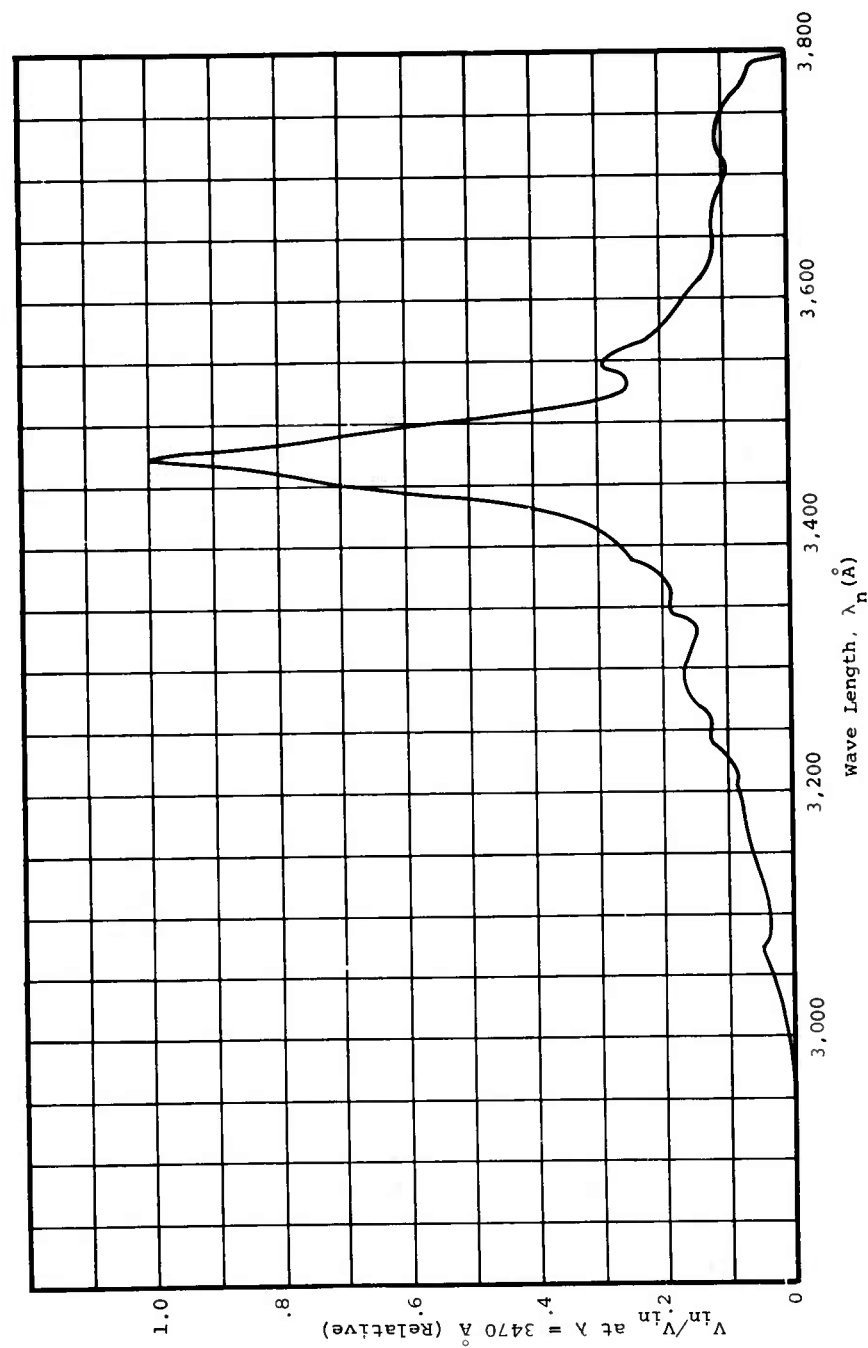


Figure 3.90 Normalized UV spectrogram at H + 30 seconds,  
Kettle II, Star Fish Prime.

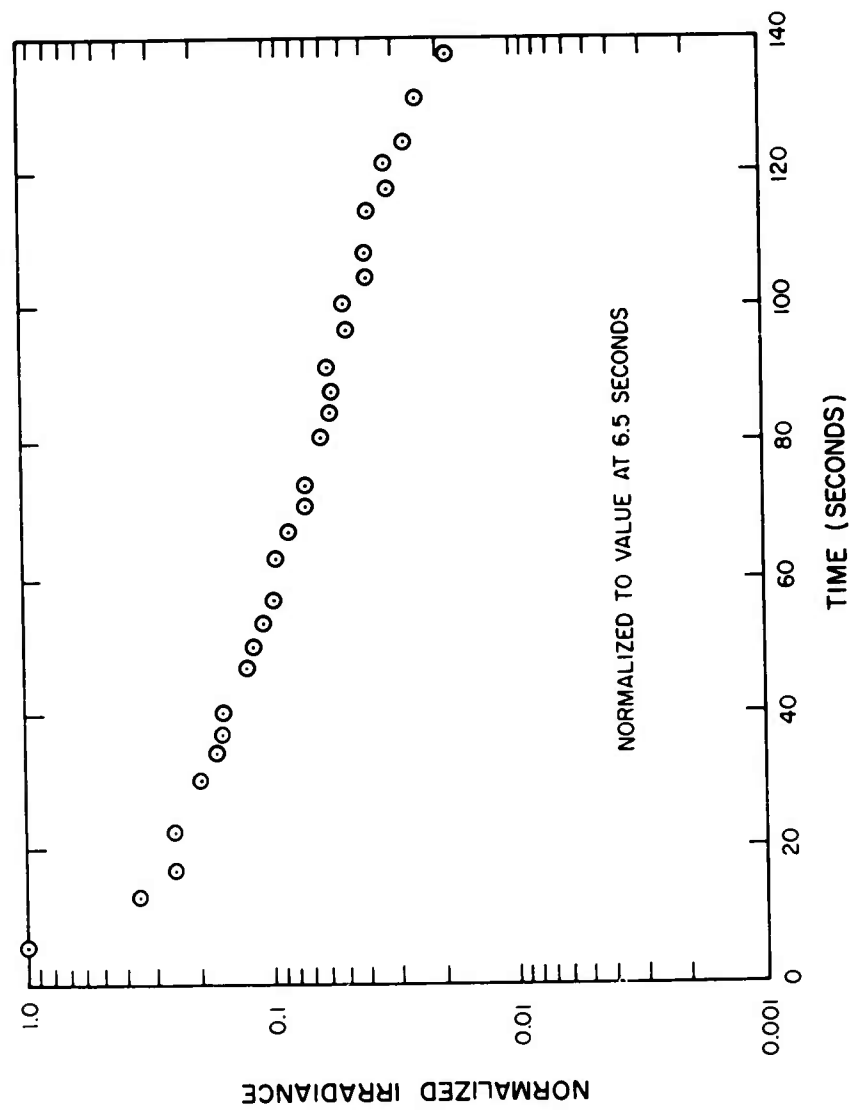
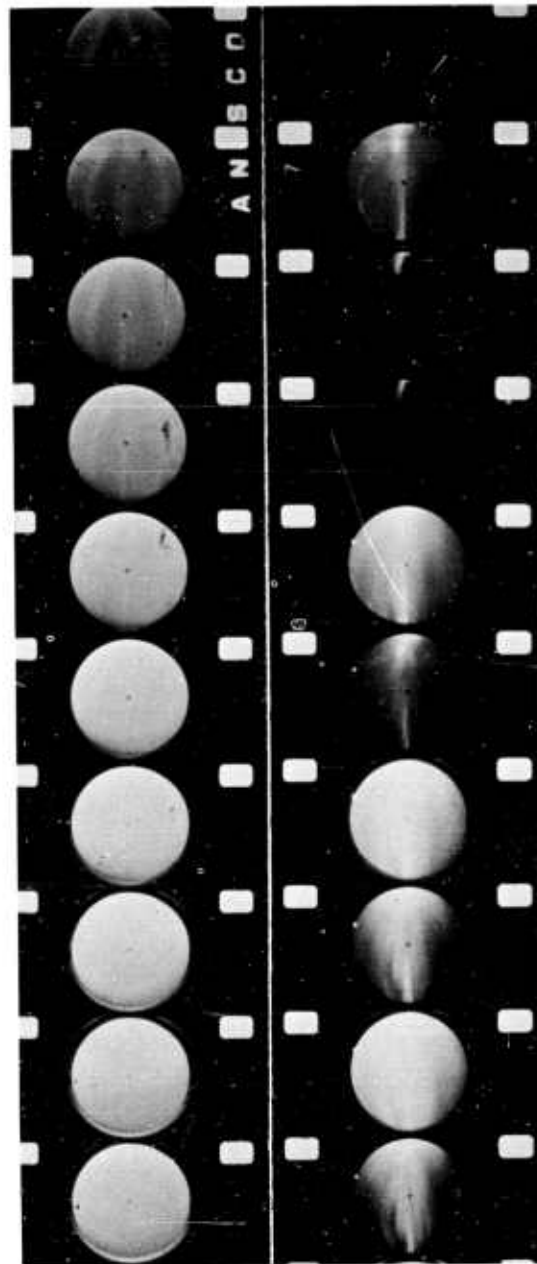
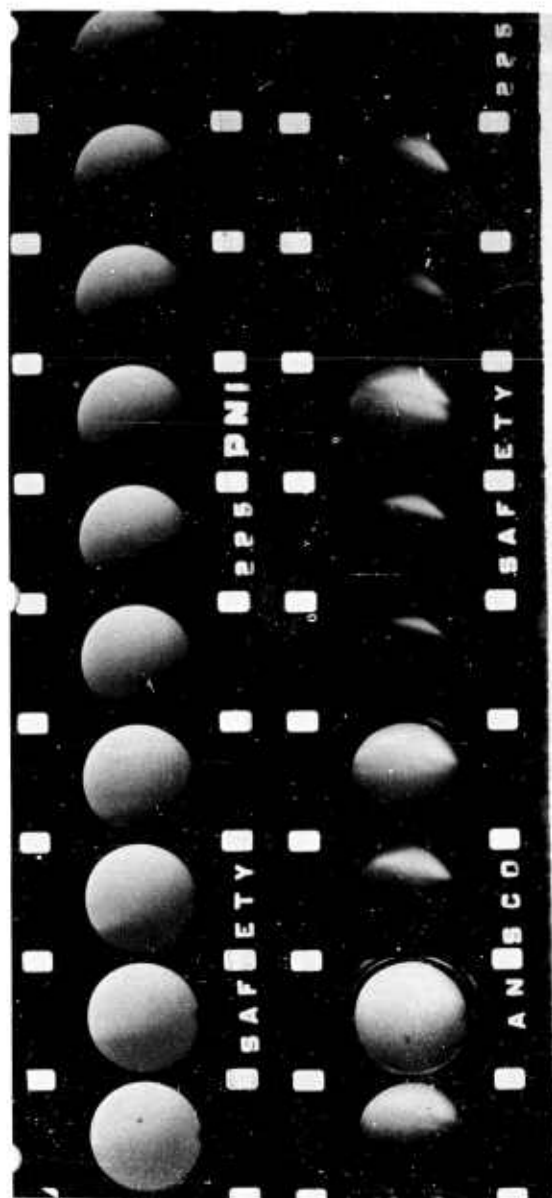


Figure 3.91 Decay of 3,470-Angstrom band, Star Fish Prime.



Top row starts at 0.35 sec, 1/100-sec  
exposures each 1/10 sec  
Bottom row 42 to 153 sec, exposures  
from 2 to 25 sec  
Kettle I - N 805-km range from burst  
T/1.64 - Super Anscochrome  
All-Sky Frame Width 1550 thru window

Figure 3.92 All-sky camera photos, Kettle I, Star Fish Prime.



Top row starts at 0.35 sec, 1/100-sec  
exposures each 1/10 sec  
Bottom row 42 to 153 sec, exposures  
from 2 to 25 sec  
Kettle II - E 540-km range from burst  
T/1.64 - Super Anscochrome  
All-Sky Frame Width 155° thru window

Figure 3.93 All-sky camera photos, Kettle II, Star Fish Prime.

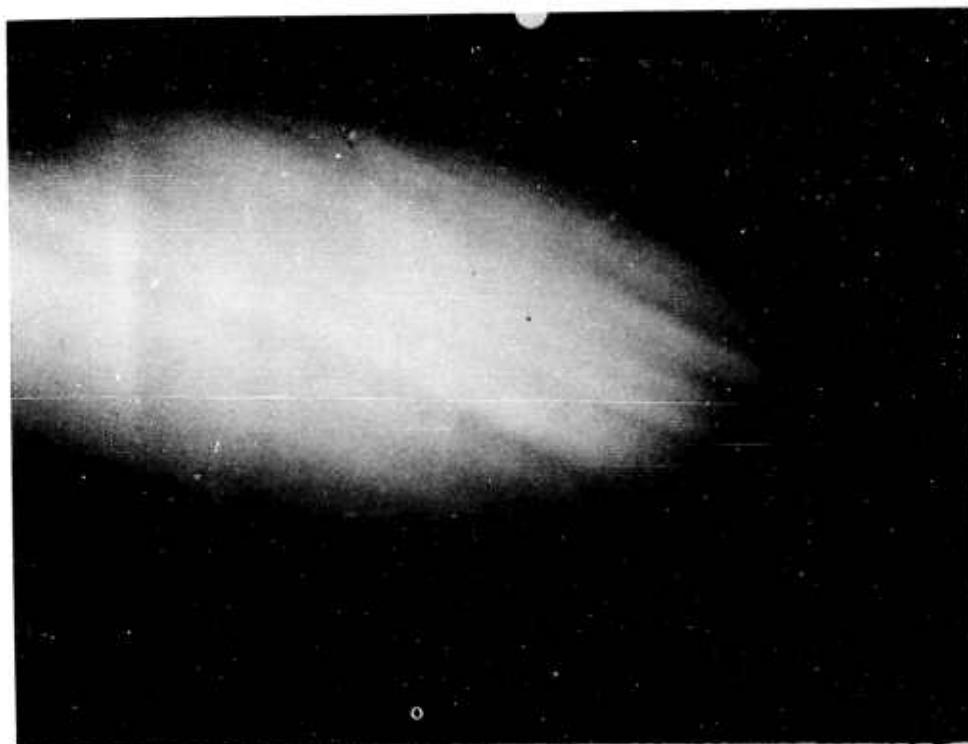






Left 108 to 133 sec-Right 138 to 163 sec  
 Johnston - 400 km to burst  
 T/2.0 - Super Anscochrome  
 Frame Width 730  
 Camera axis 40 from magnetic N-S  
 N is left, burst is 8° from center

Figure 3.95 All-sky camera photos, Johnston, Star Fish Prime.



122 to 146 sec — f/2.8 — SA-C  
Kettle II - 540 km  
Frame Width 42°

Figure 3.96 70-mm camera photo, Kettle II, Star Fish Prime.

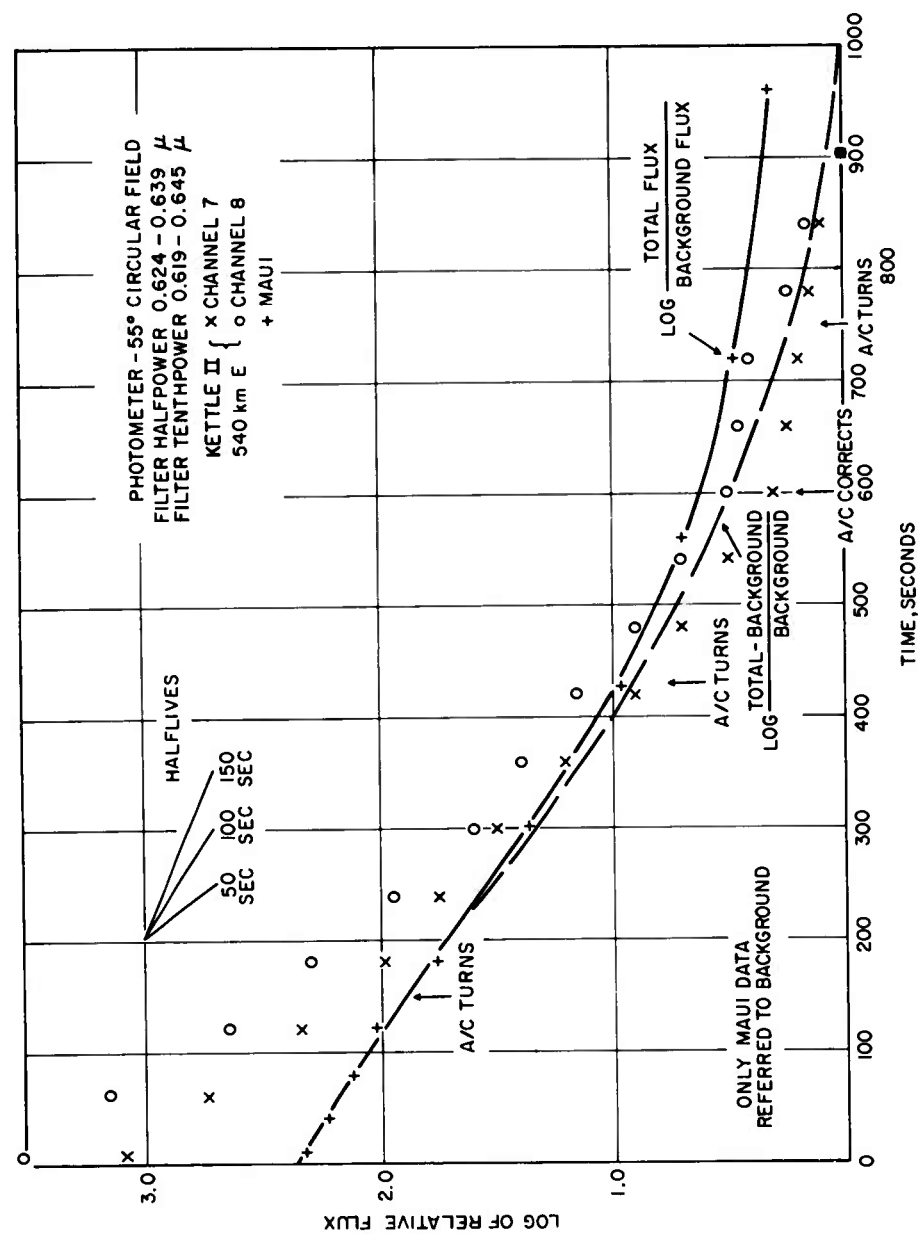


Figure 3.97 Photometer results (visible), Kettle II, and Maui, Star Fish Prime.

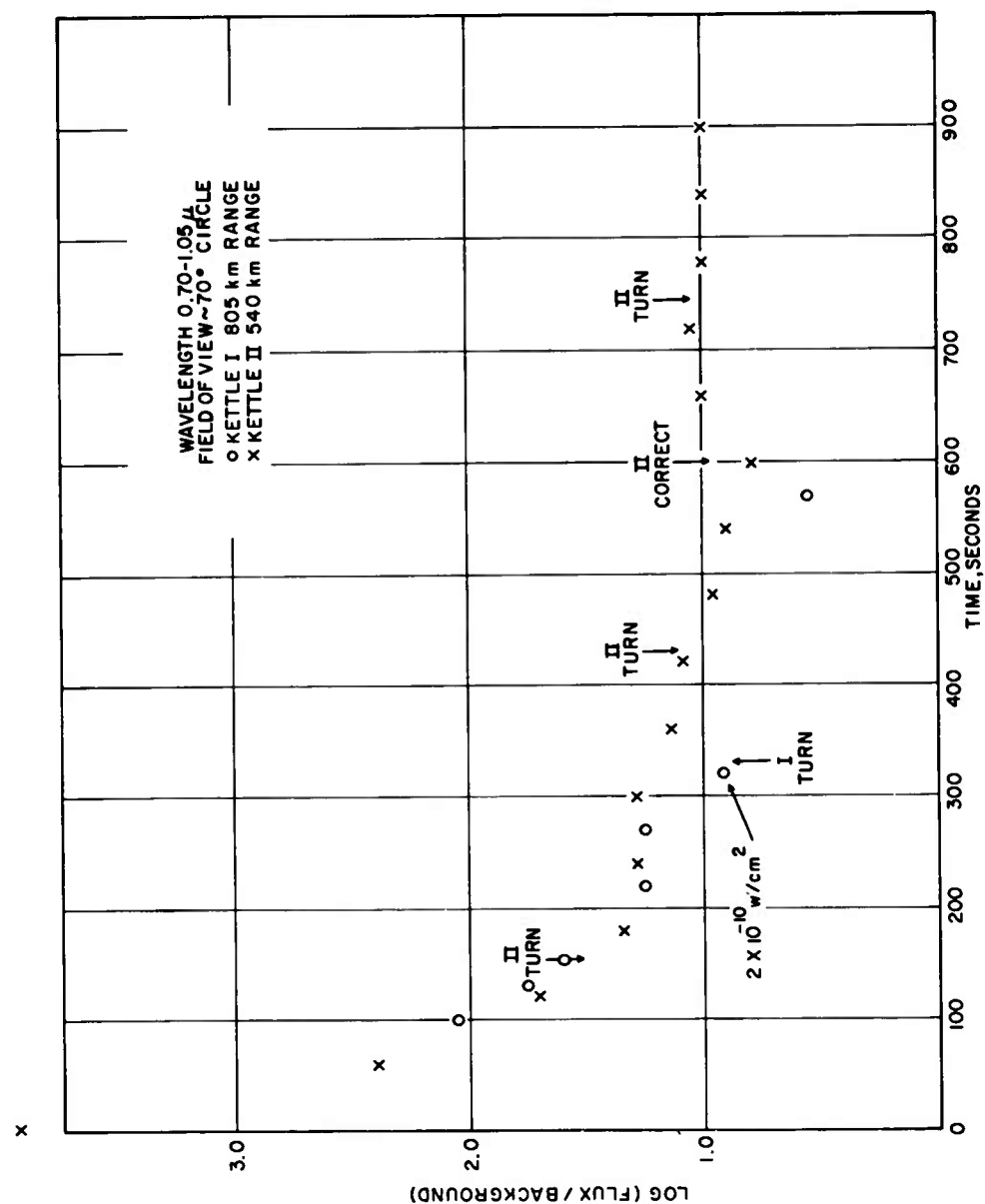


Figure 3.98 Photometer results (near IR) from aircraft station,  
 Star Fish Prime.

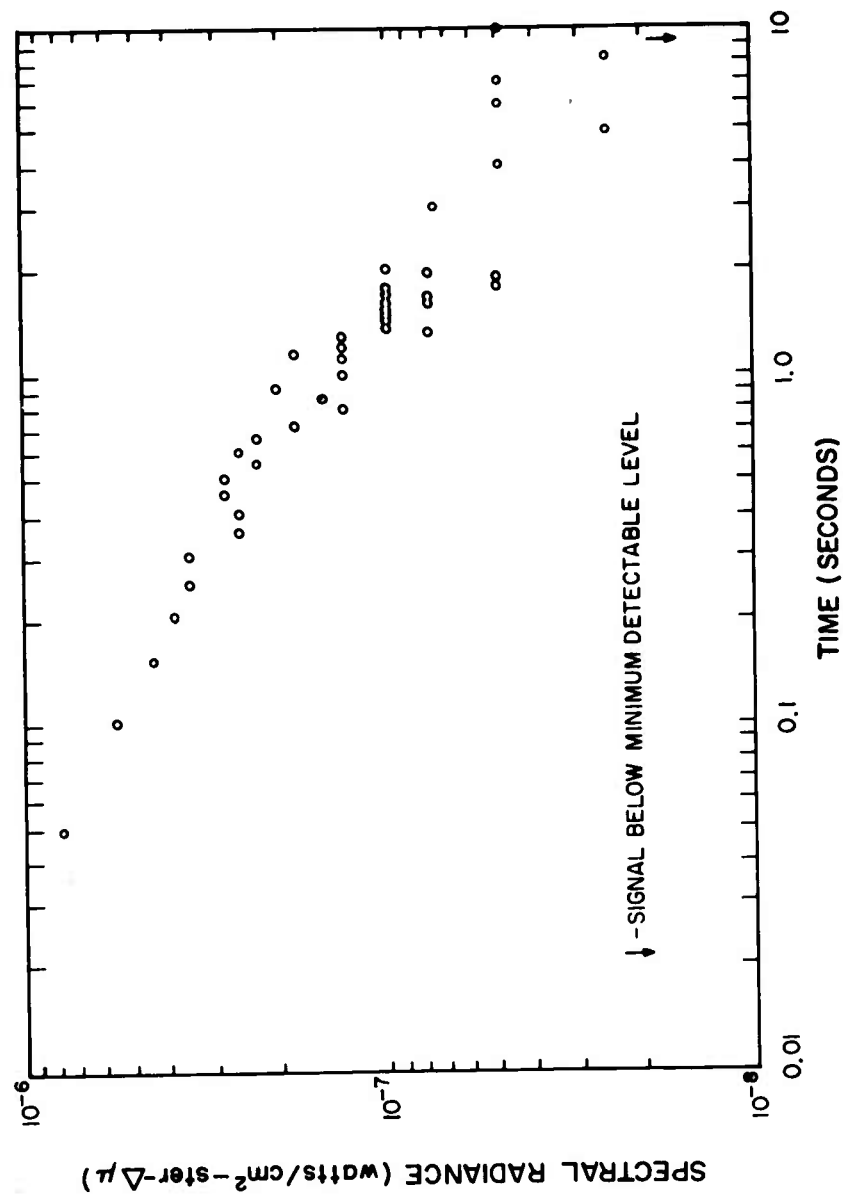


Figure 3.99 Spectral radiance, Kettle I, Check Mate,  
Channel 1, early time.

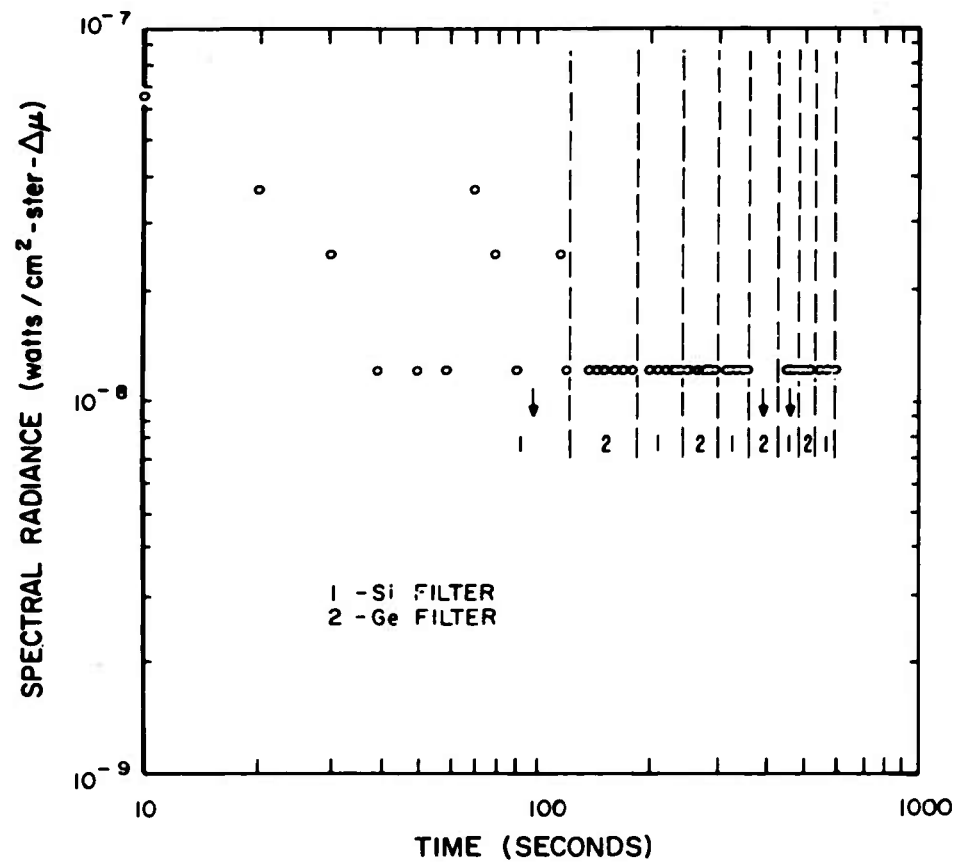


Figure 3.100 Spectral radiance, Kettle I, Check Mate, Channel 1, late time.

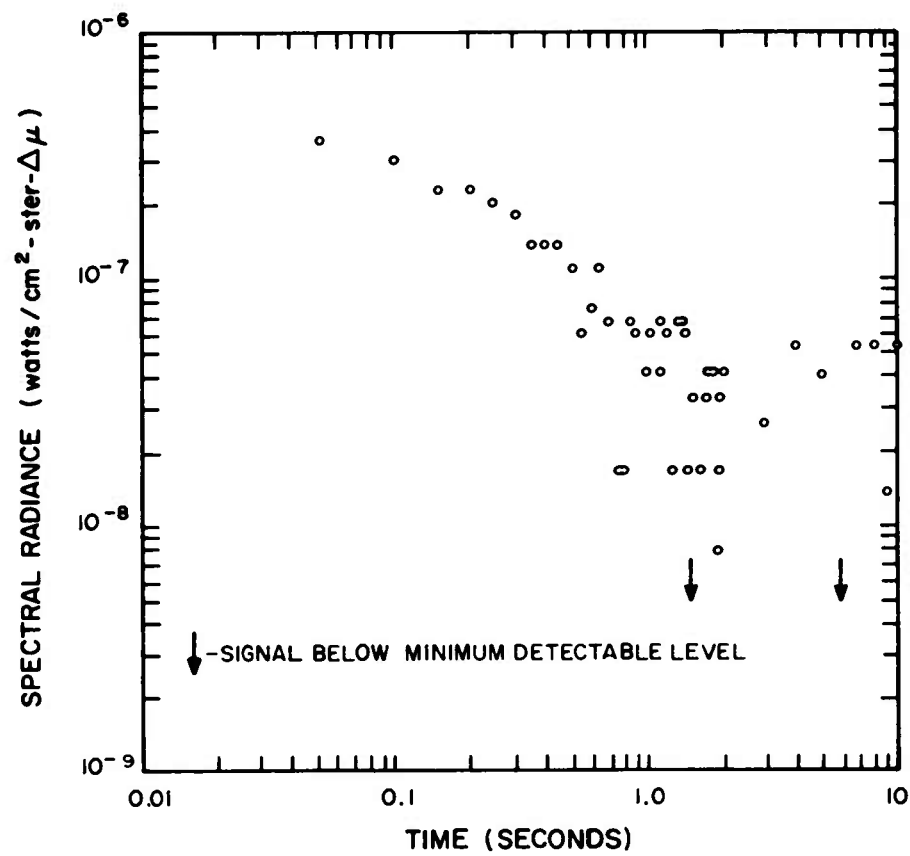


Figure 3.101 Spectral radiance, Kettle I, Check Mate, Channel 2, early time.



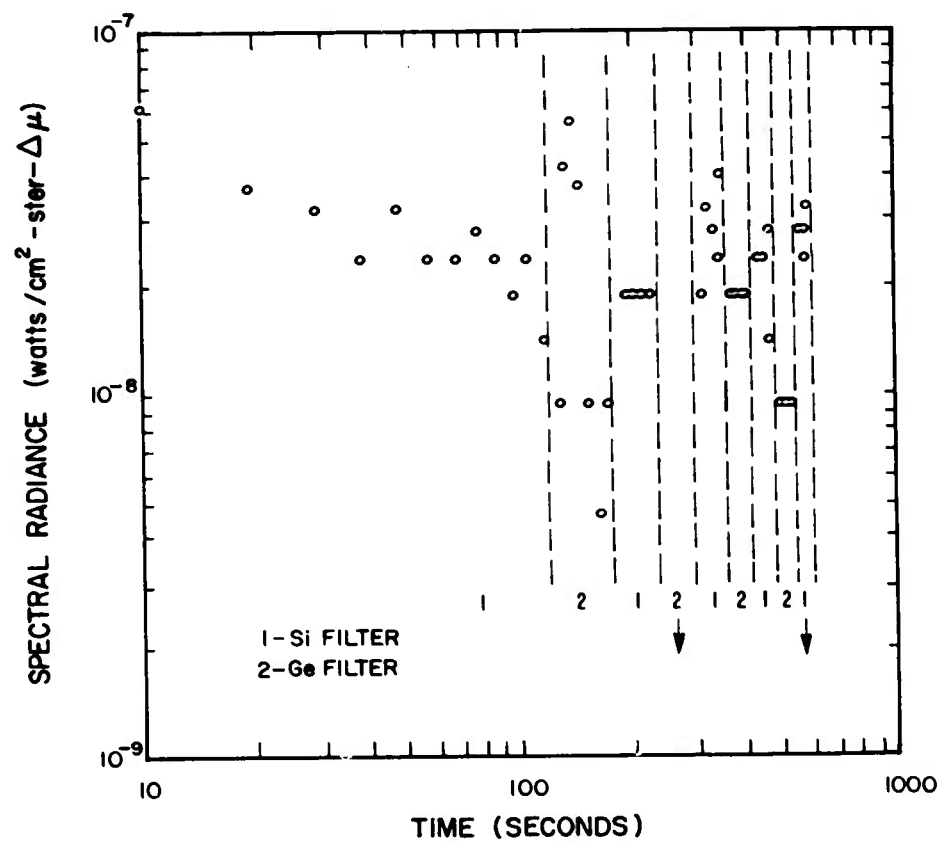


Figure 3.102 Spectral radiance, Kettle I, Check Mate, Channel 2, late time.

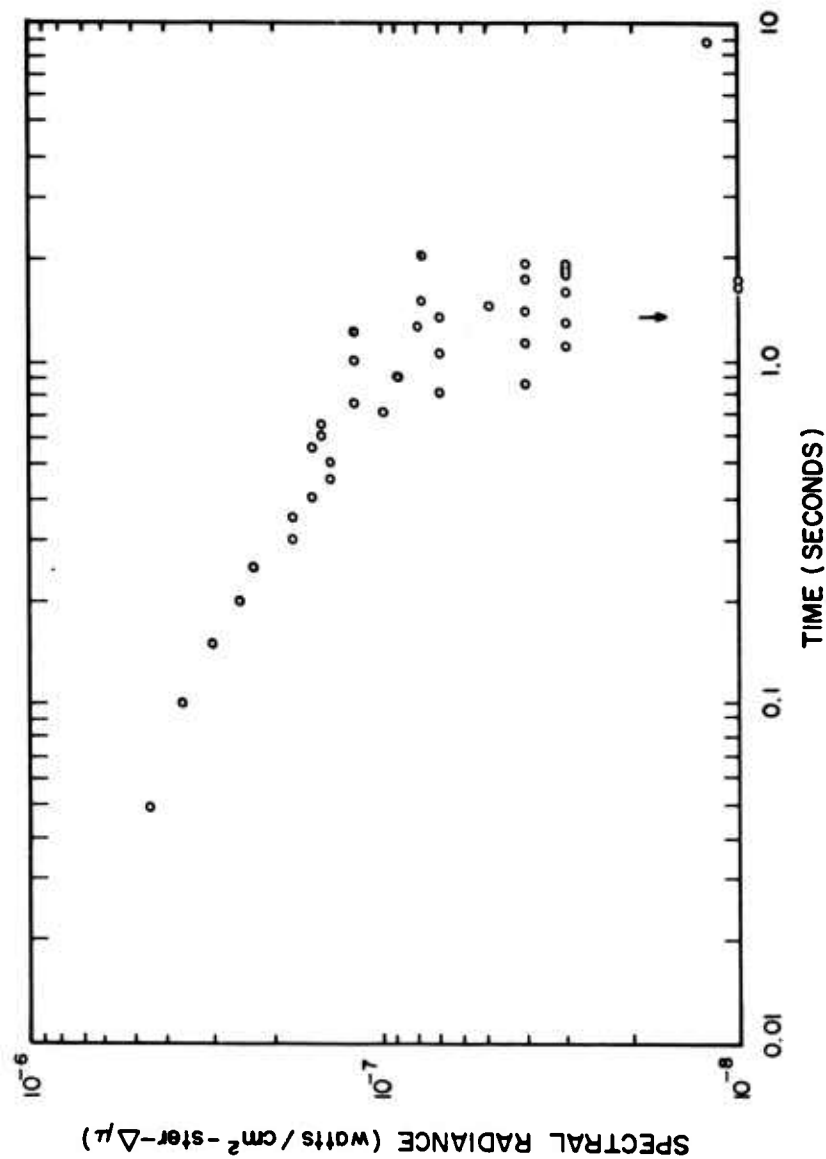


Figure 3.103 Spectral radiance, Kettle I, Check Mate, Channel 4, early time.

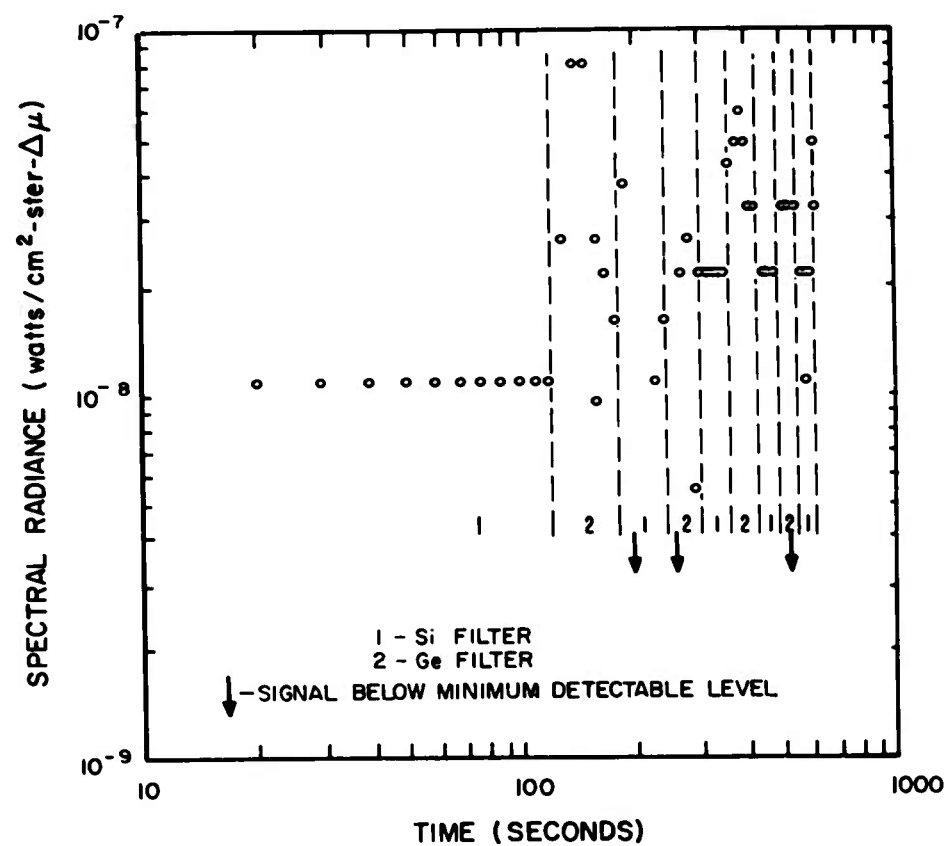


Figure 3.104 Spectral radiance, Kettle I, Check Mate, Channel 4, late time.

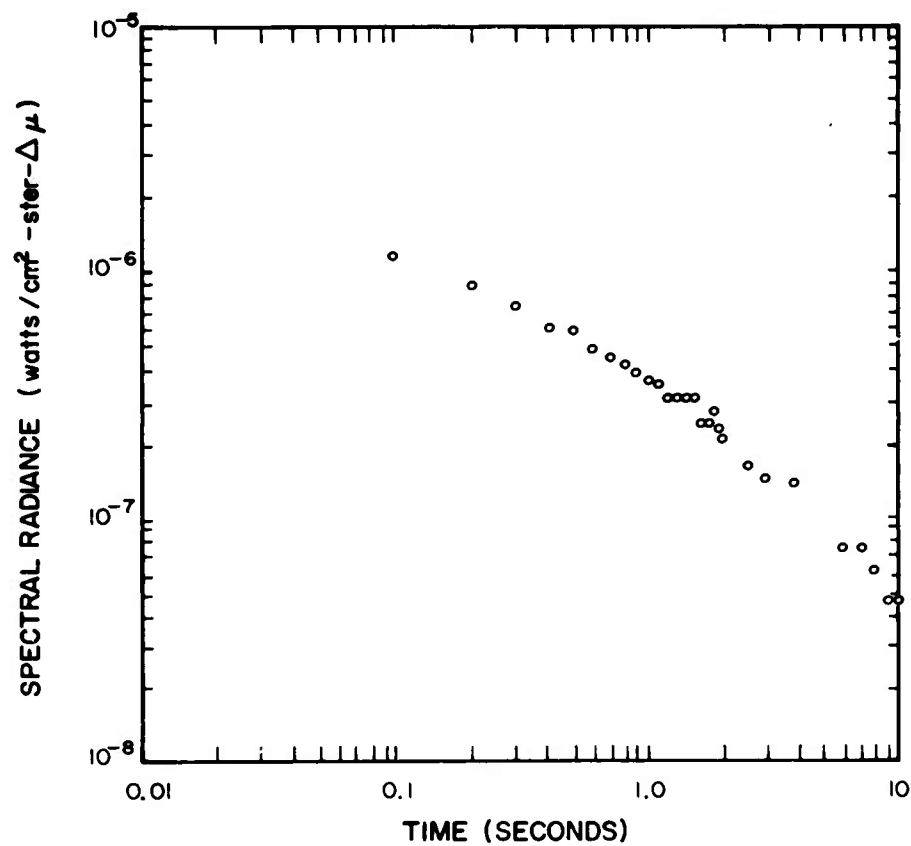


Figure 3.105 Spectral radiance, Kettle I, Check Mate, Channel 5, early time.

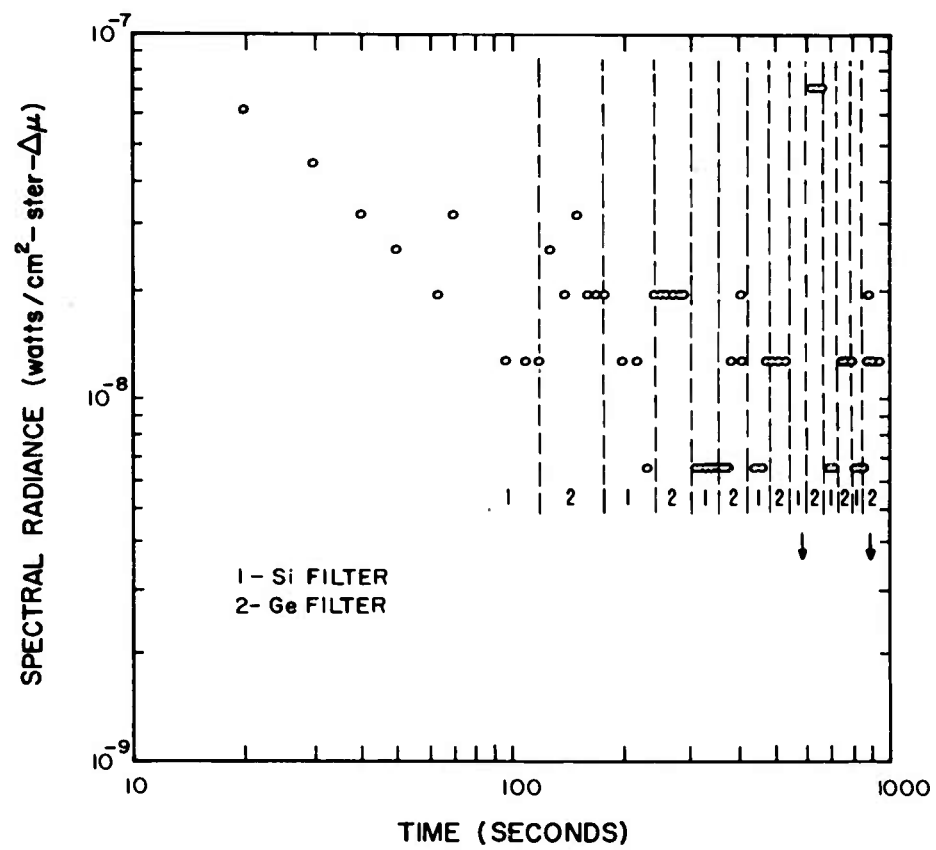


Figure 3.106 Spectral radiance, Kettle I, Check Mate, Channel 5, late time.

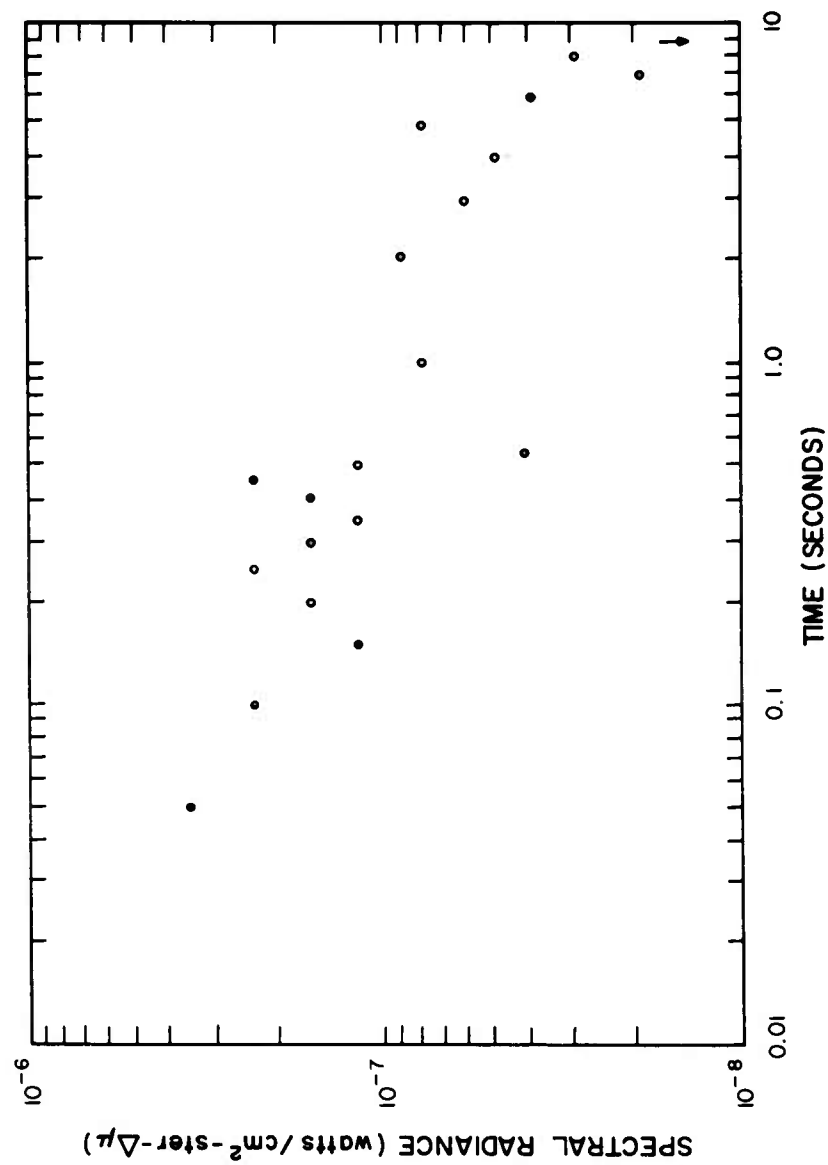


Figure 3.107 Spectral radiance, Kettle I, Check Mate, Channel 6, early time.

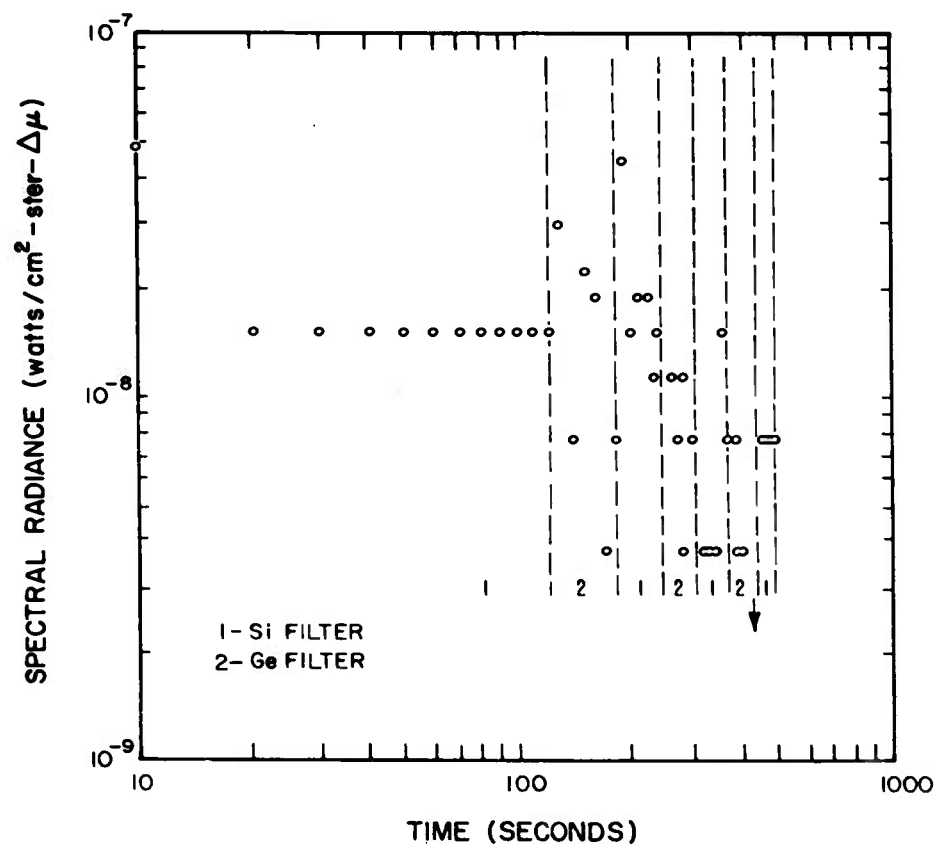


Figure 3.108 Spectral radiance, Kettle I, Check Mate, Channel 6, late time.

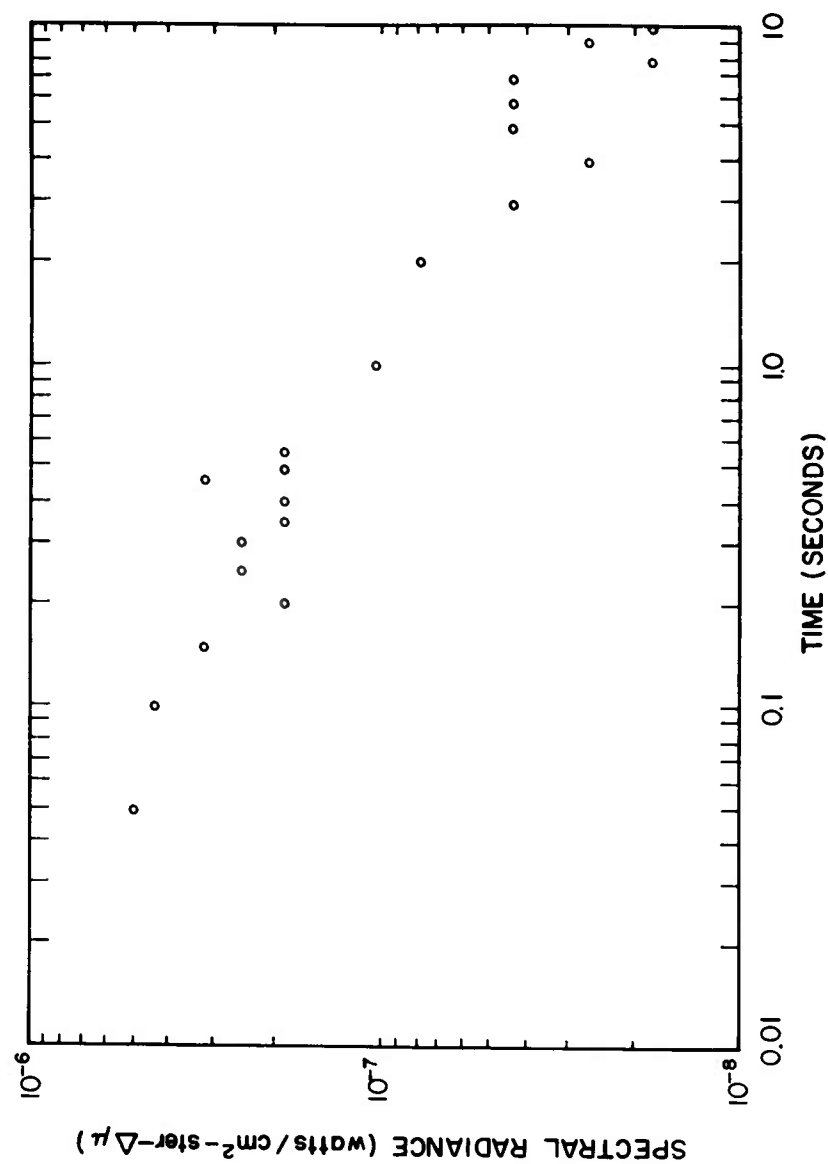


Figure 3.109 Spectral radiance, Kettle I, Check Mate, Channel 7, early time.



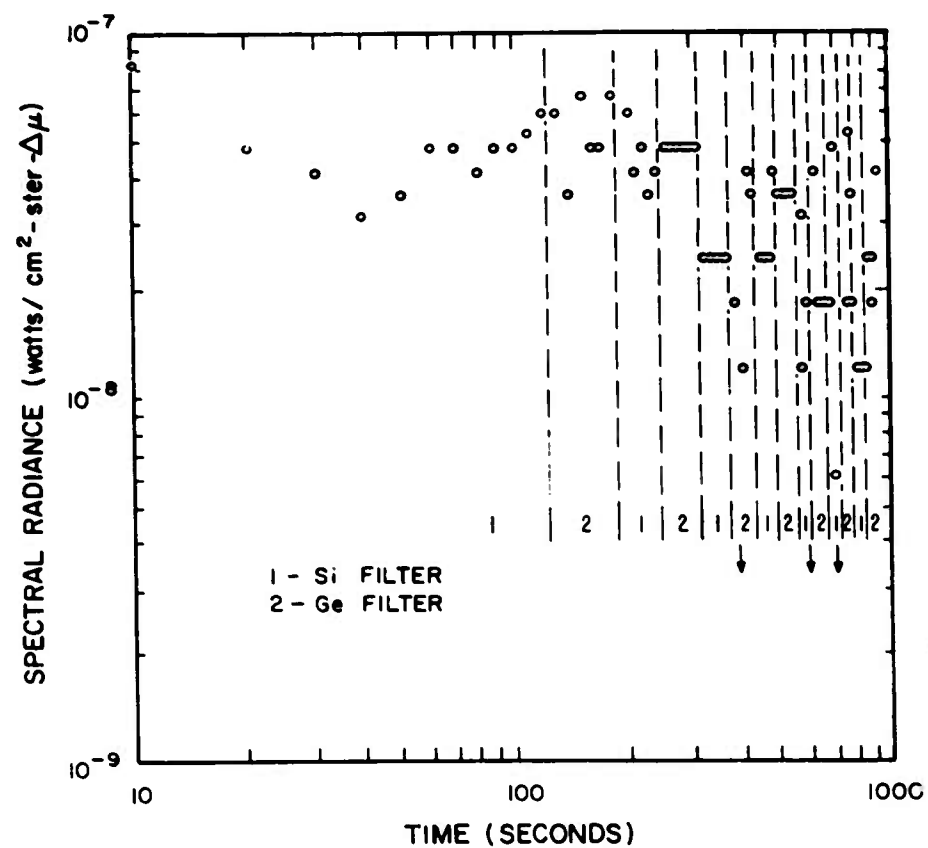


Figure 3.110 Spectral radiance, Kettle I, Check Mate, Channel 7, late time.

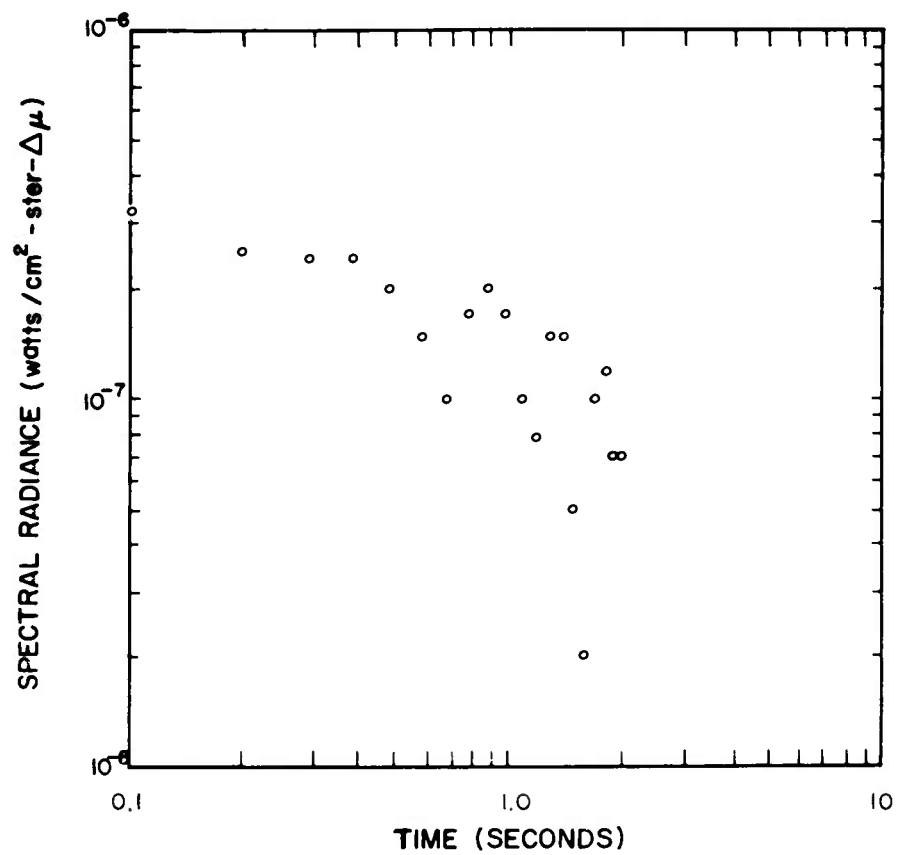


Figure 3.111 Spectral radiance, Kettle I, Check Mate, Channel 14.

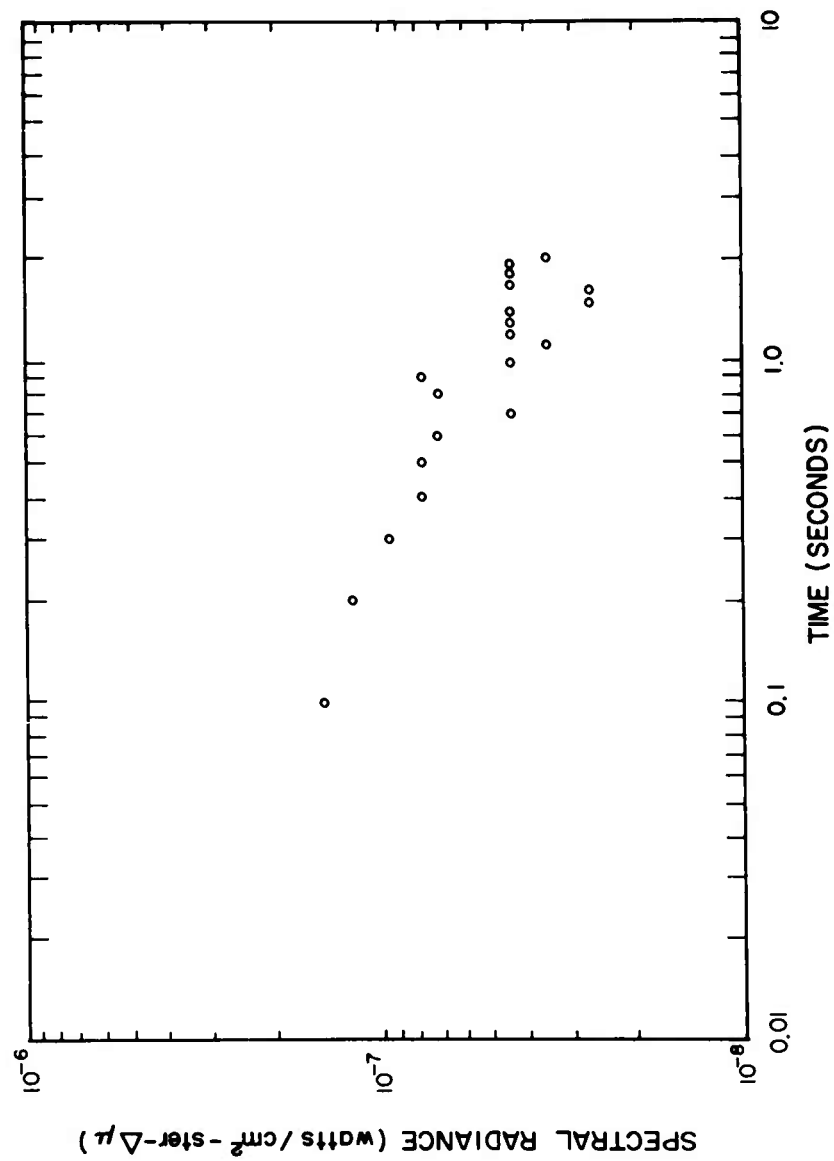


Figure 3.112 Spectral radiance, Kettle I, Check Mate, Channel 15.

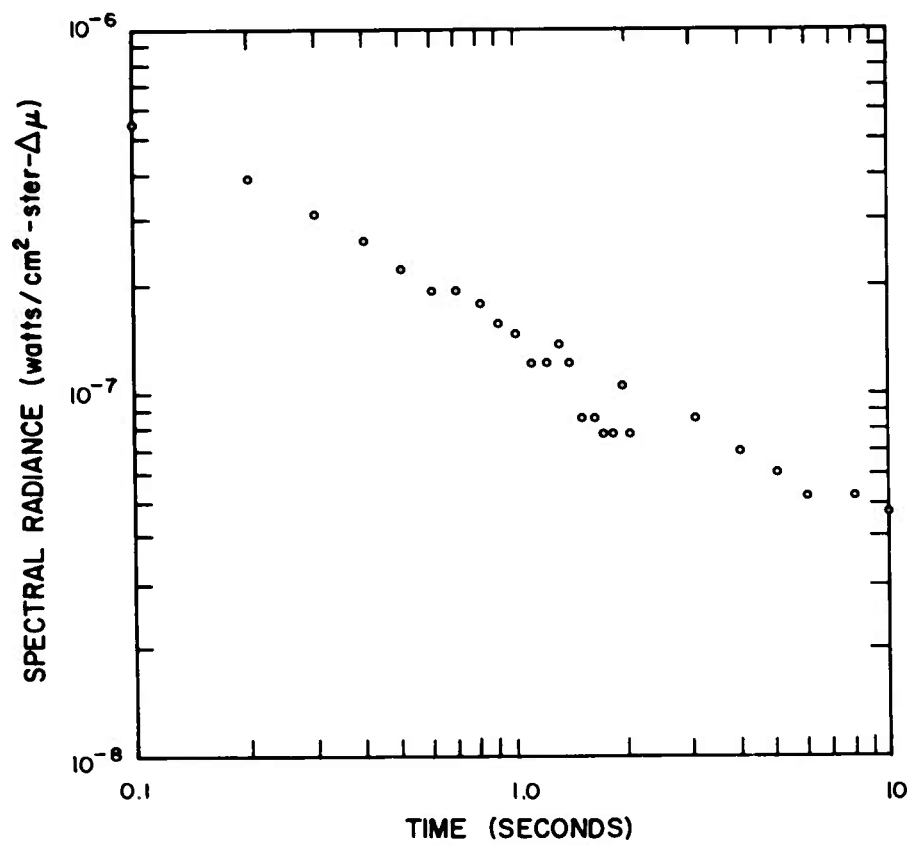


Figure 3.113 Spectral radiance, Kettle II, Check Mate, Channel 1, early time.

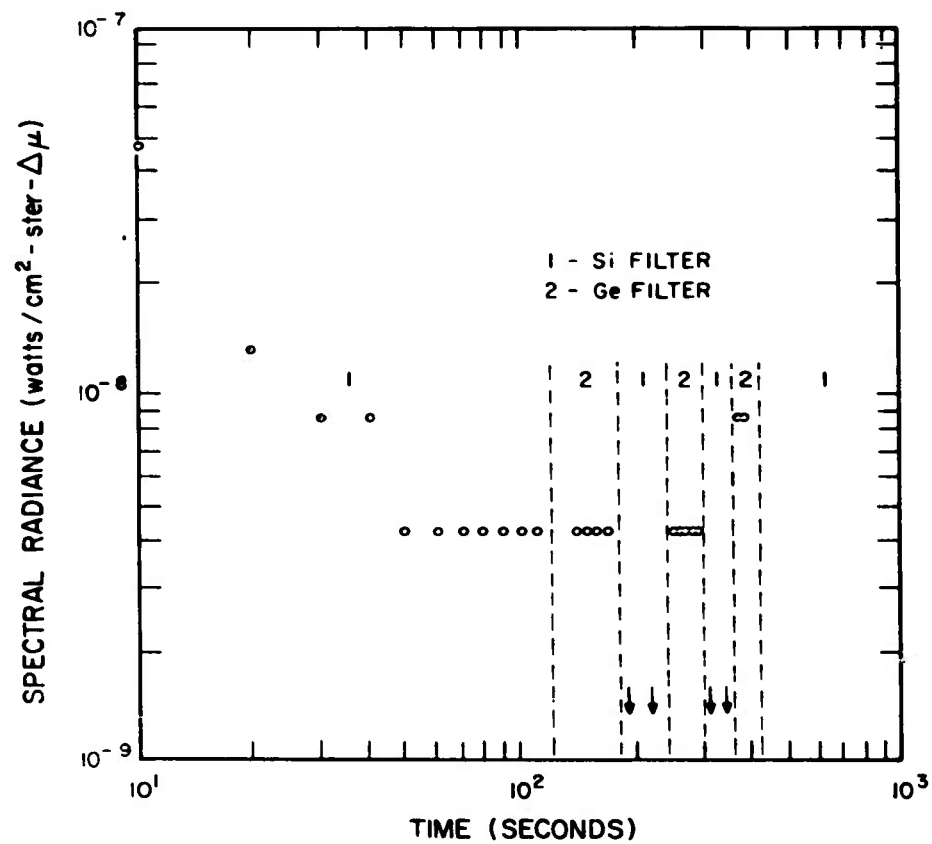


Figure 3.114 Spectral radiance, Kettle II, Check Mate, Channel 1, late time.

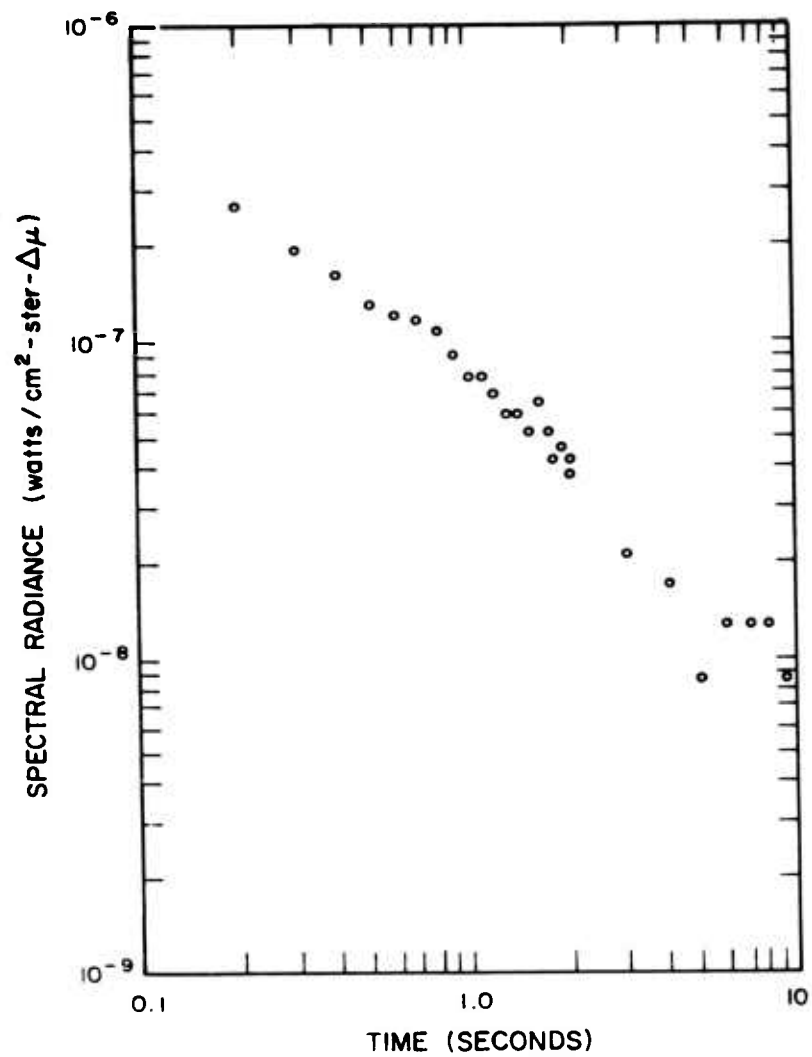


Figure 3.115 Spectral radiance, Kettle II, Check Mate, Channel 2, early time.

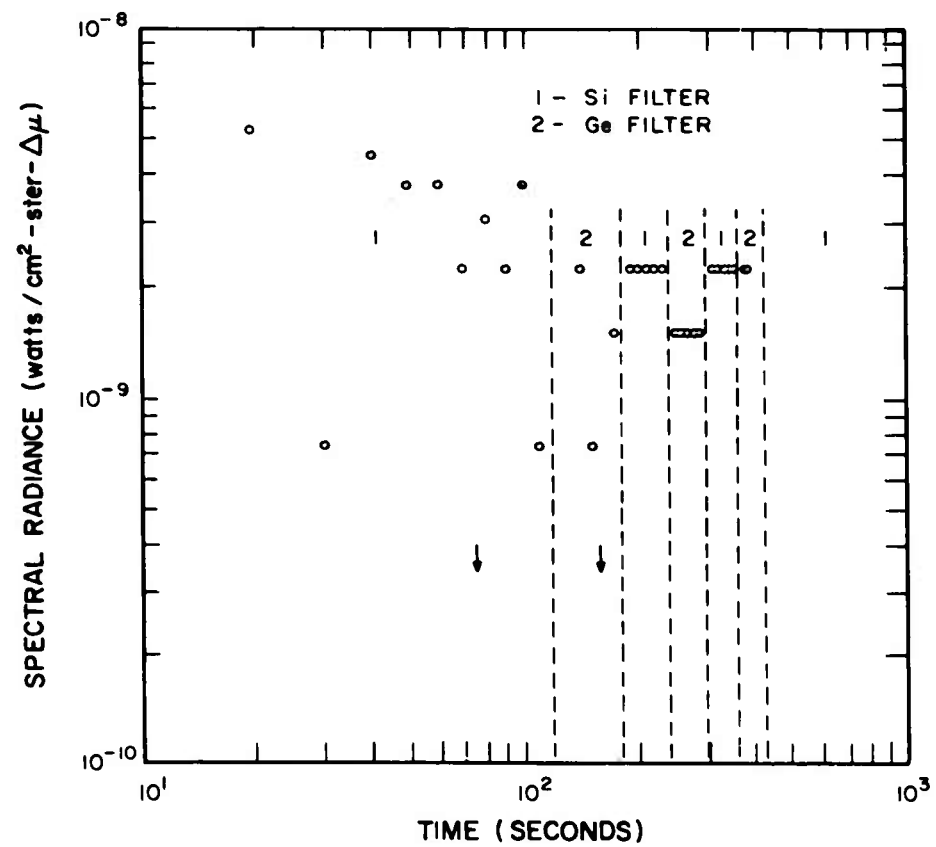


Figure 3.116 Spectral radiance, Kettle II, Check Mate, Channel 2, late time.

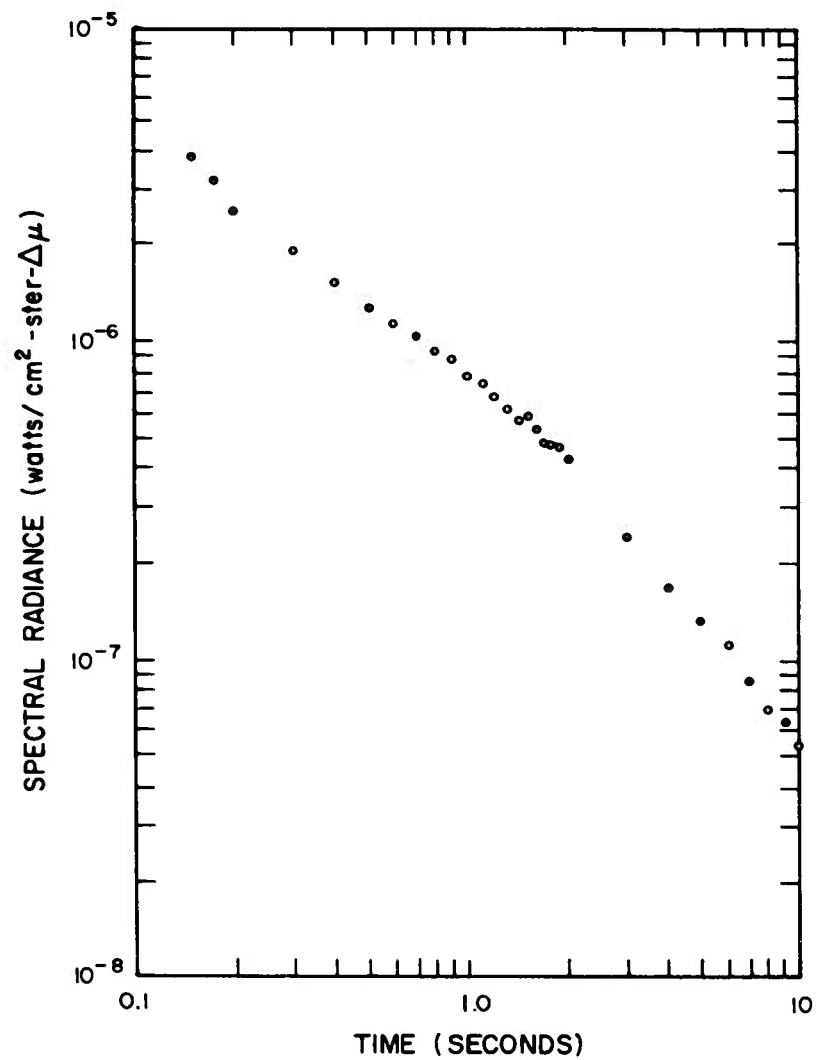


Figure 3.117 Spectral radiance, Kettle II, Check Mate, Channel 3, early time.



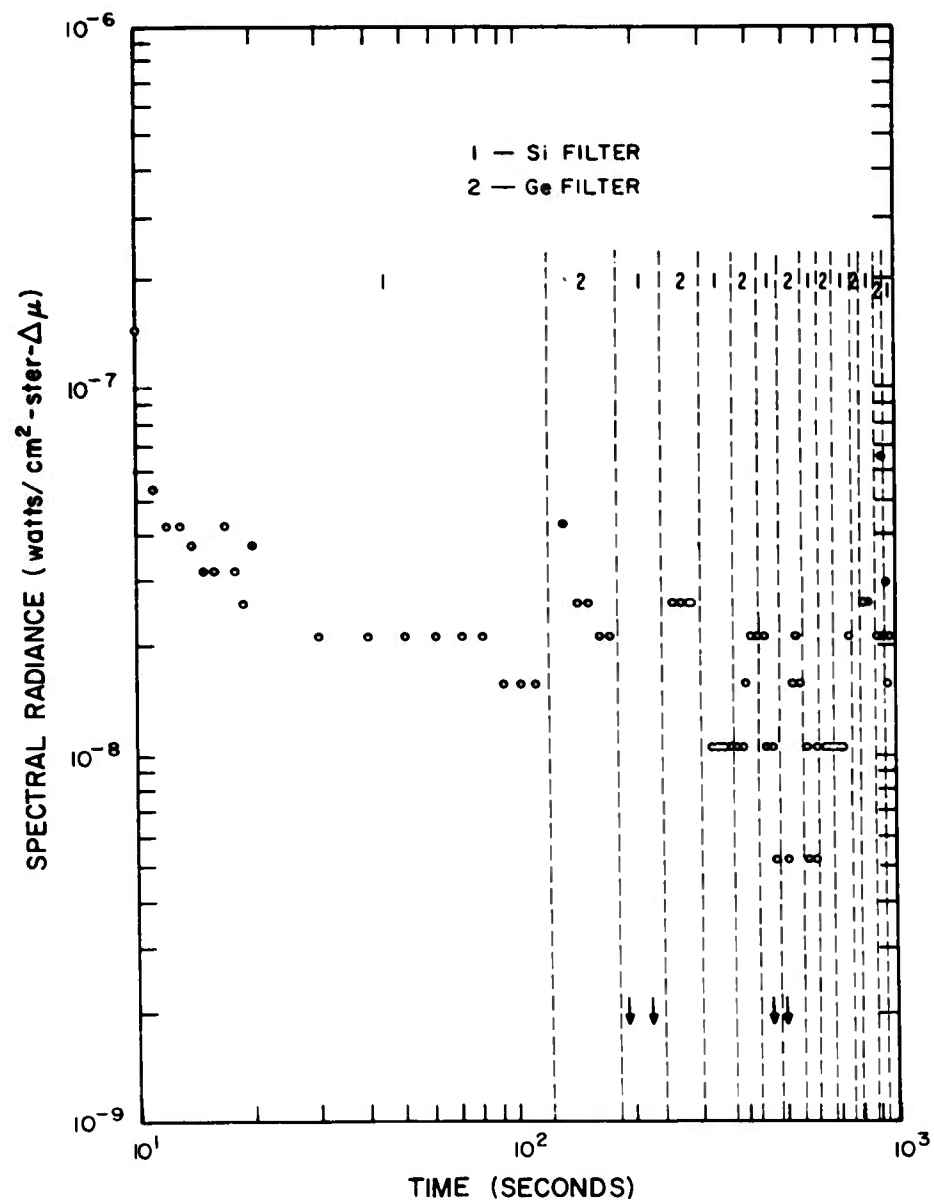


Figure 3.118 Spectral radiance, Kettle II, Check Mate, Channel 3, late time.

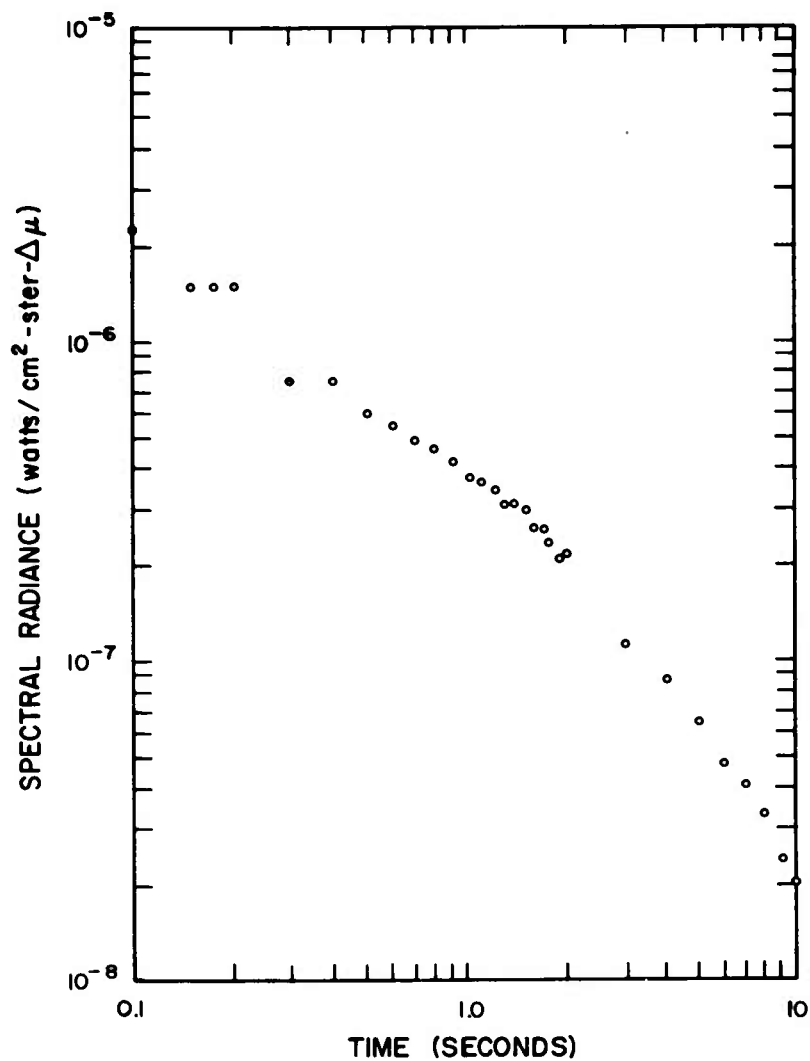


Figure 3.119 Spectral radiance, Kettle II, Check Mate, Channel 4, early time.

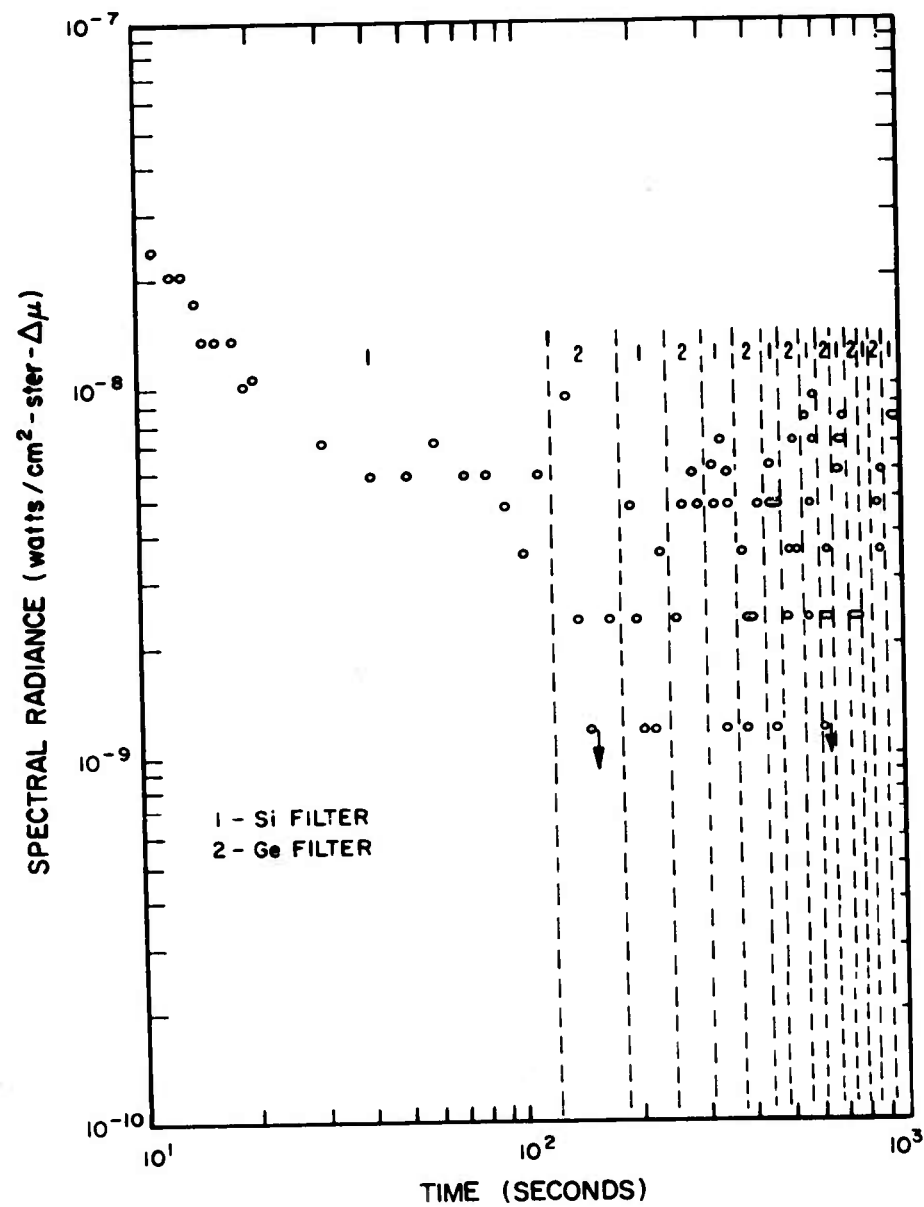


Figure 3.120 Spectral radiance, Kettle II, Check Mate, Channel 4, late time.

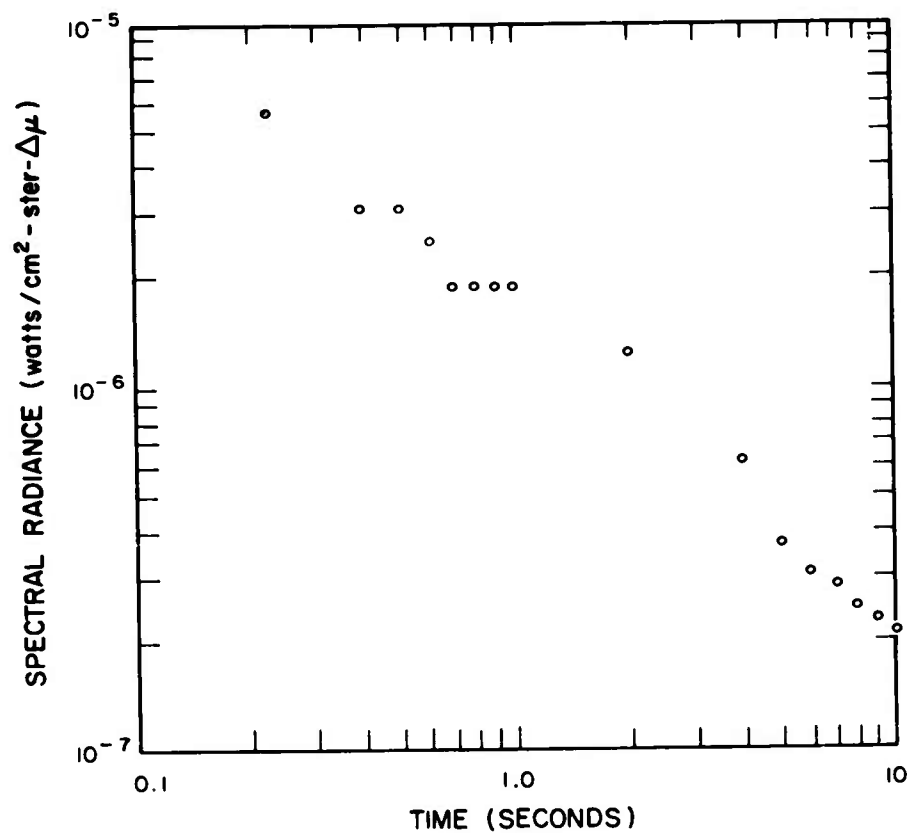


Figure 3.121 Spectral radiance, Kettle II, Check Mate, Channel 5, early time.

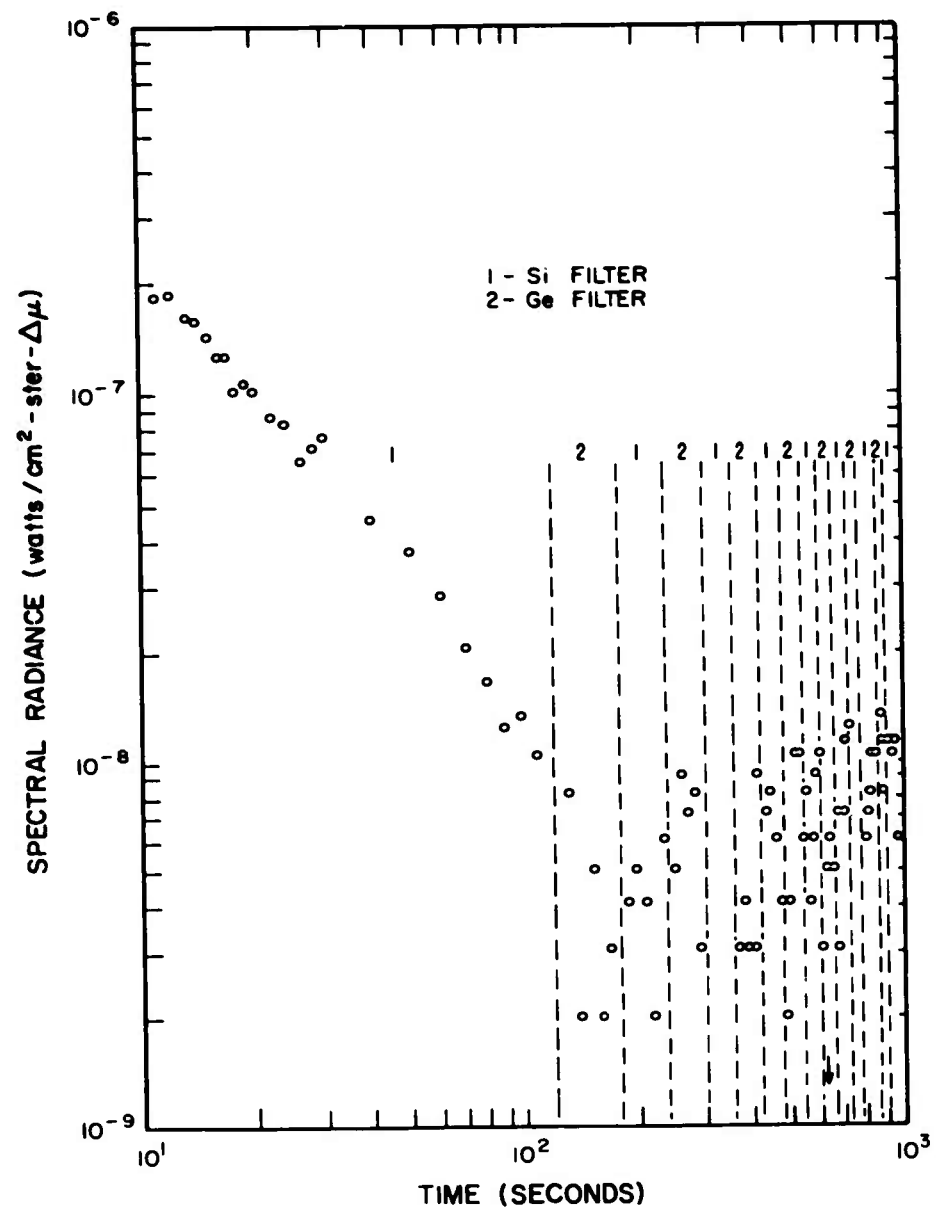


Figure 3.122 Spectral radiance, Kettle II, Check Mate, Channel 5, late time.

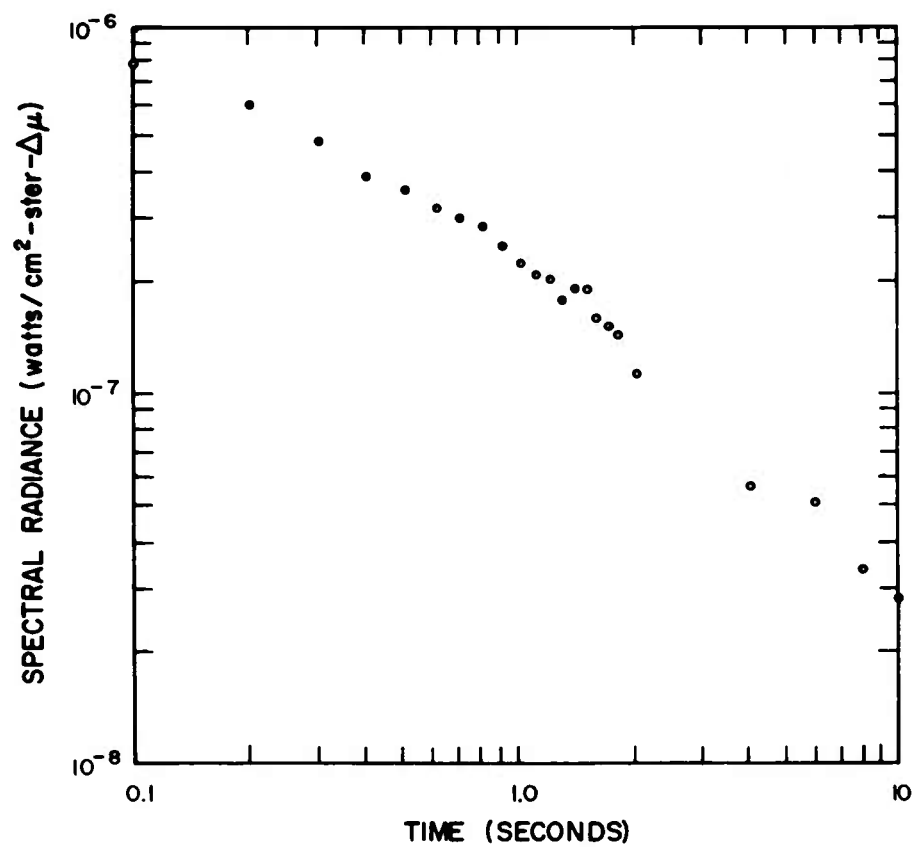


Figure 3.123 Spectral radiance, Kettle II, Check Mate, Channel 7, early time.

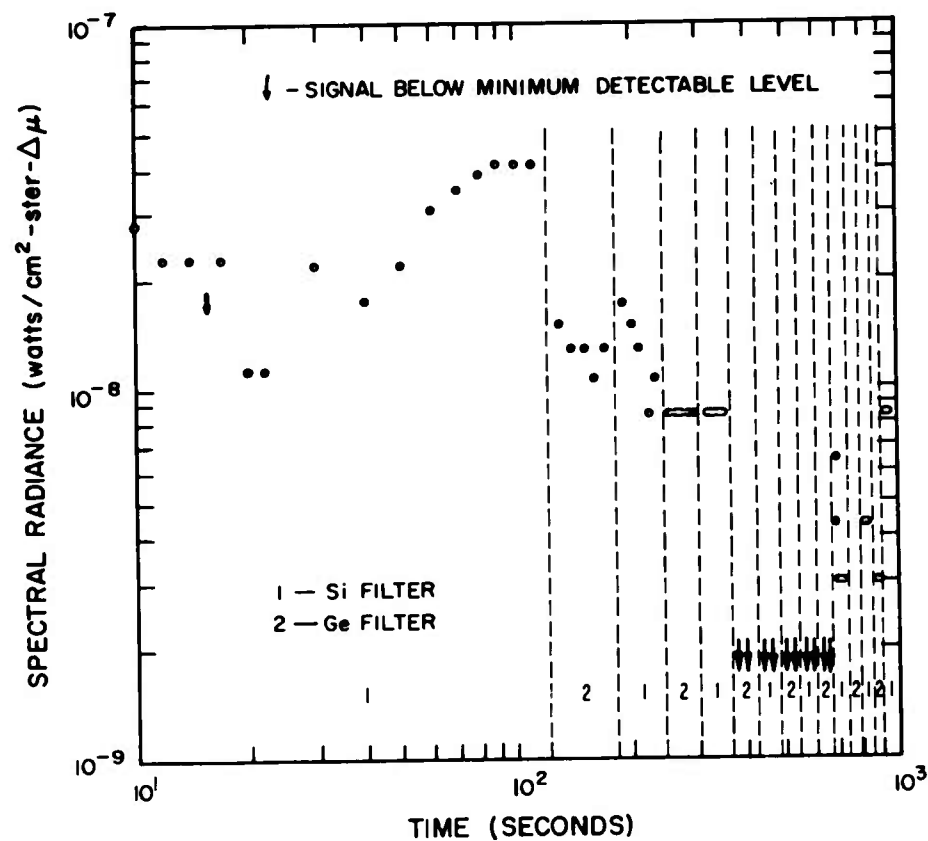


Figure 3.124 Spectral radiance, Kettle II, Check Mate, Channel 7, late time.

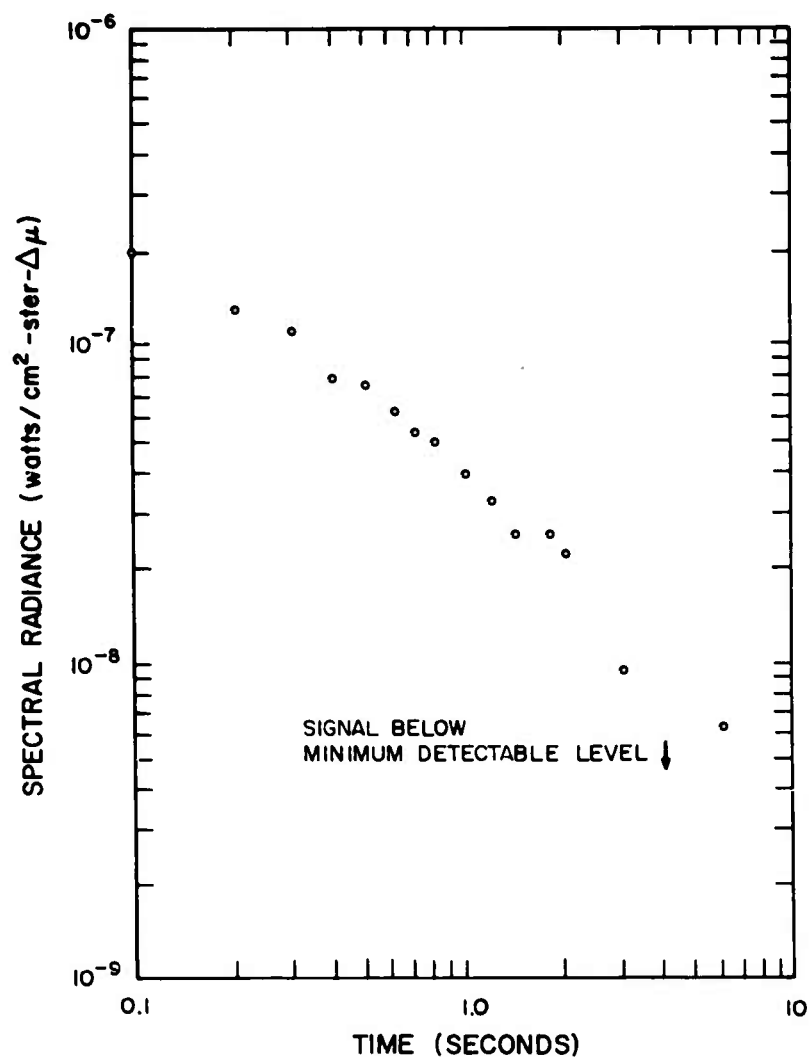


Figure 3.125 Spectral radiance, Kettle II, Check Mate, Channel 8, early time.



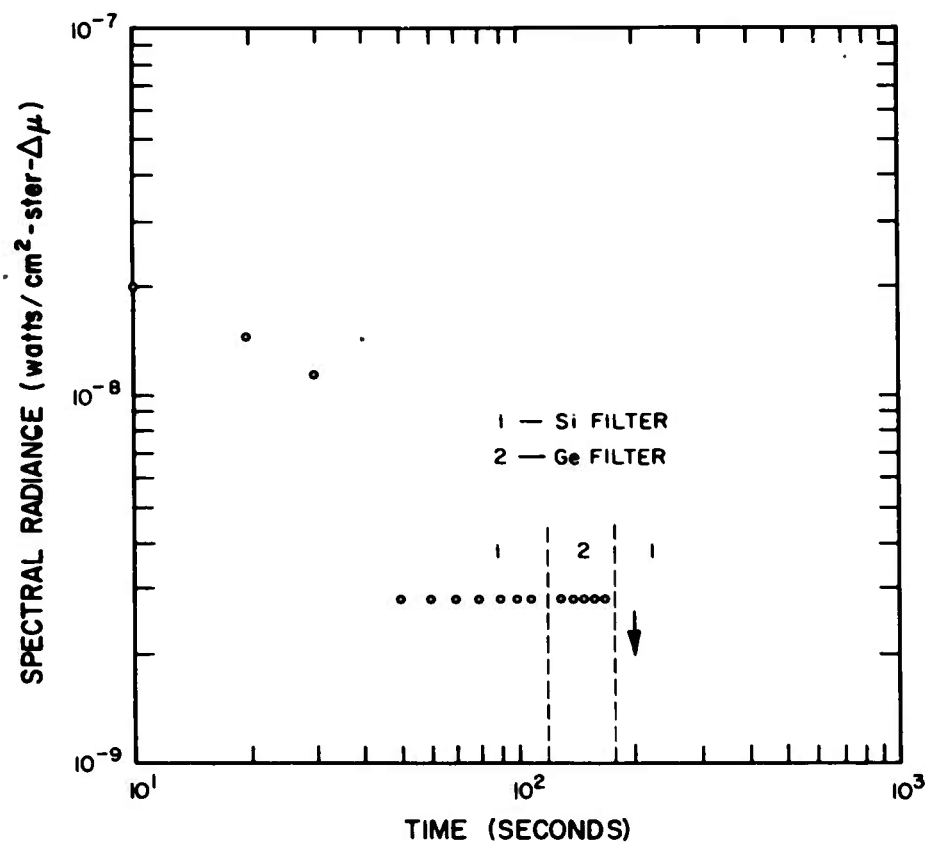


Figure 3.126 Spectral radiance, Kettle II, Check Mate, Channel 8, late time.

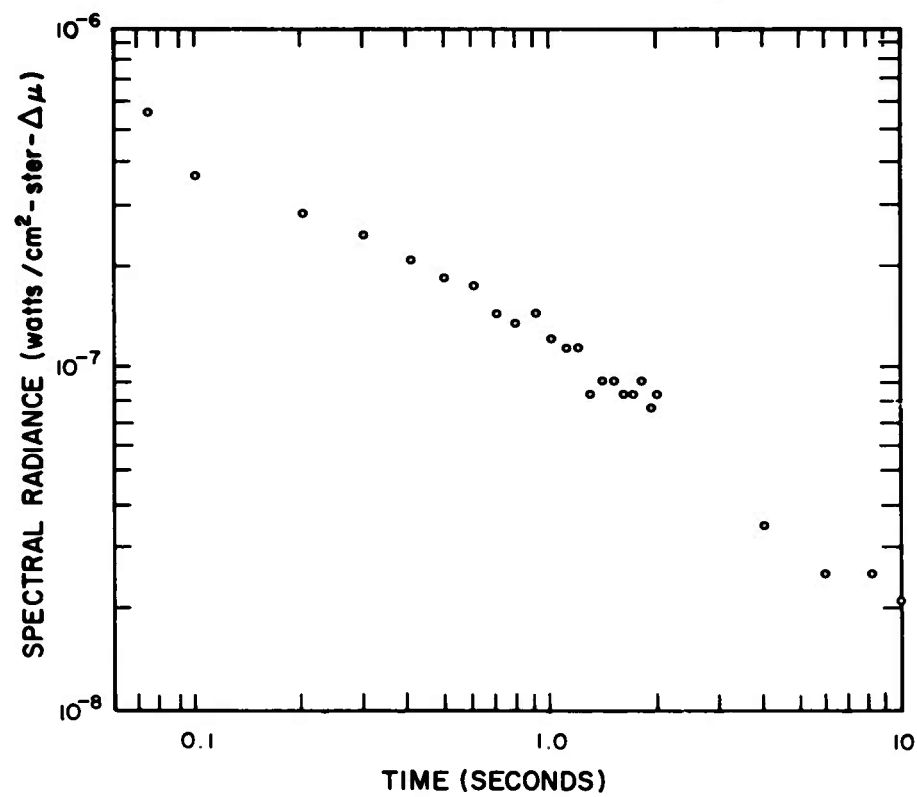


Figure 3.127 Spectral radiance, Kettle II, Check Mate, Channel 9, early time.

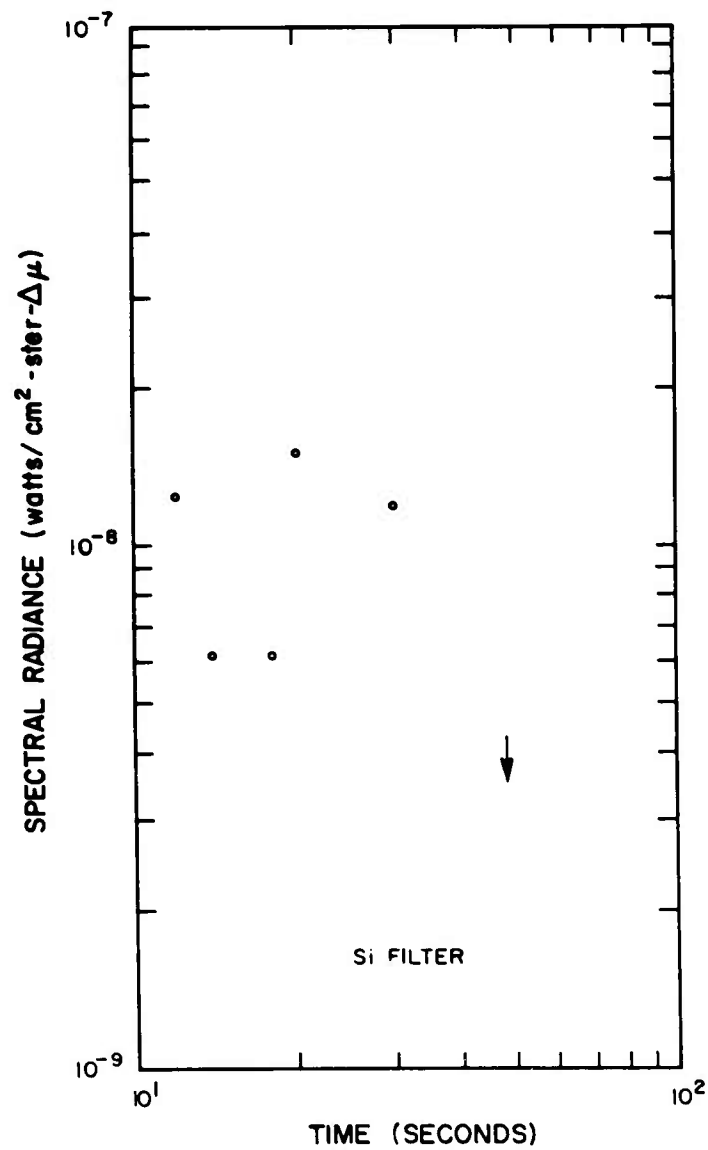


Figure 3.128 Spectral radiance, Kettle II, Check Mate, Channel 9, late time.

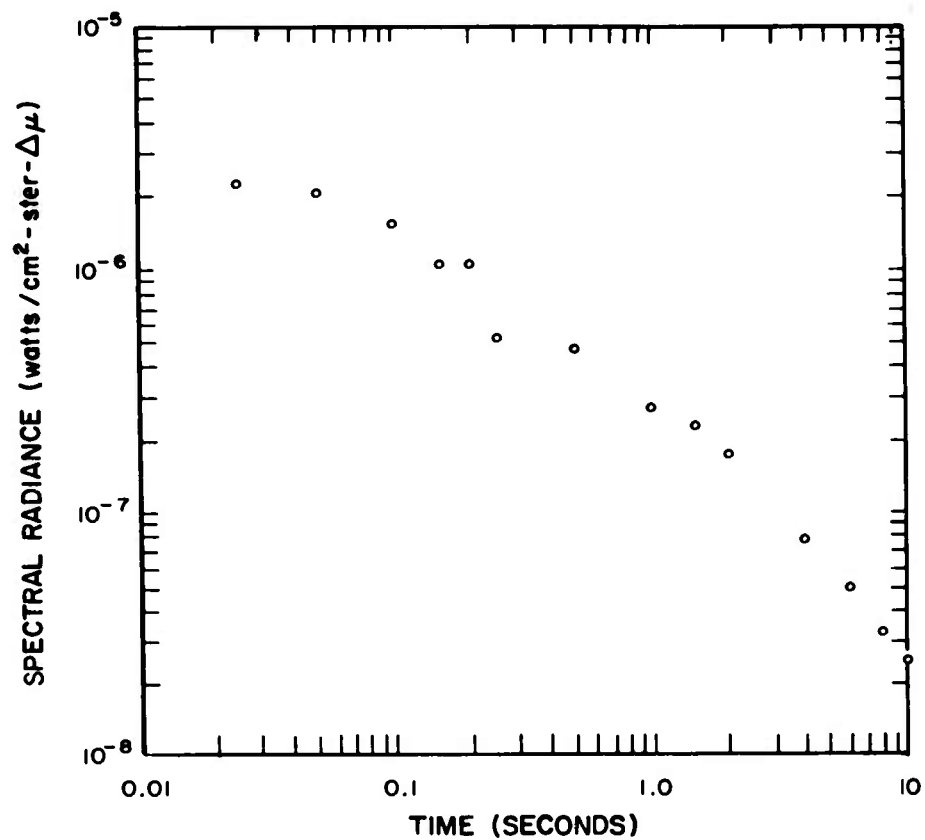


Figure 3.129 Spectral radiance, Kettle II, Check Mate, Channel 14, early time.

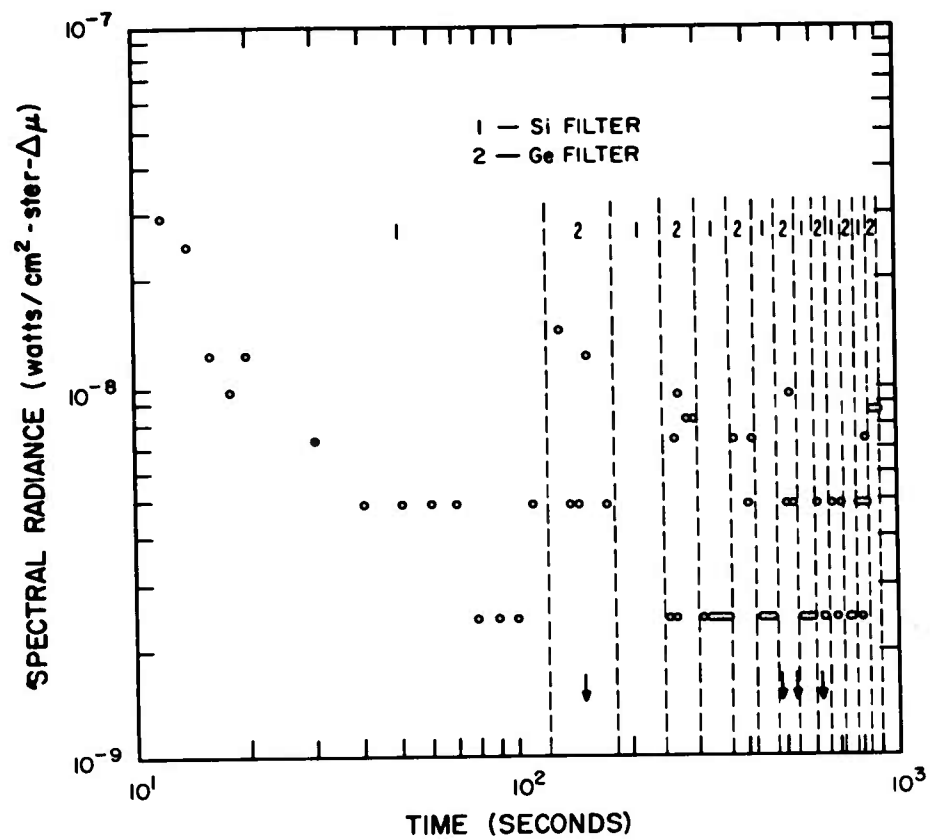


Figure 3.130 Spectral radiance, Kettle II, Check Mate, Channel 14, late time.

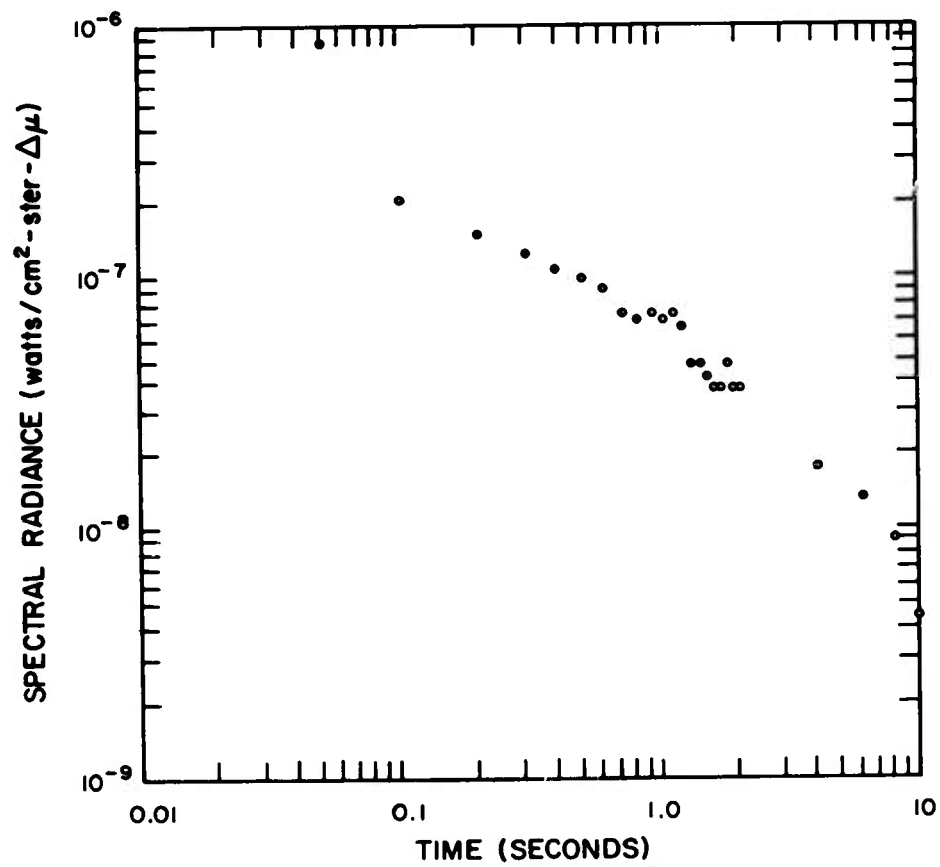


Figure 3.131 Spectral radiance, Kettle II, Check Mate, Channel 15, early time.

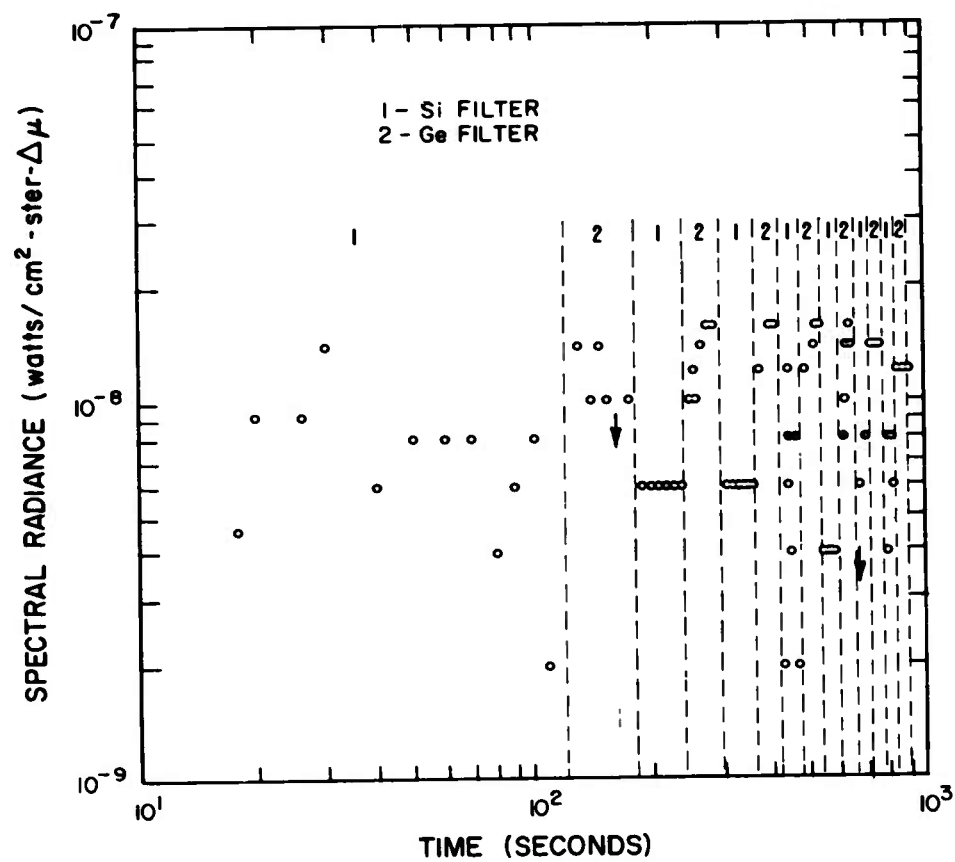


Figure 3.132 Spectral radiance, Kettle II, Check Mate, Channel 15, late time.

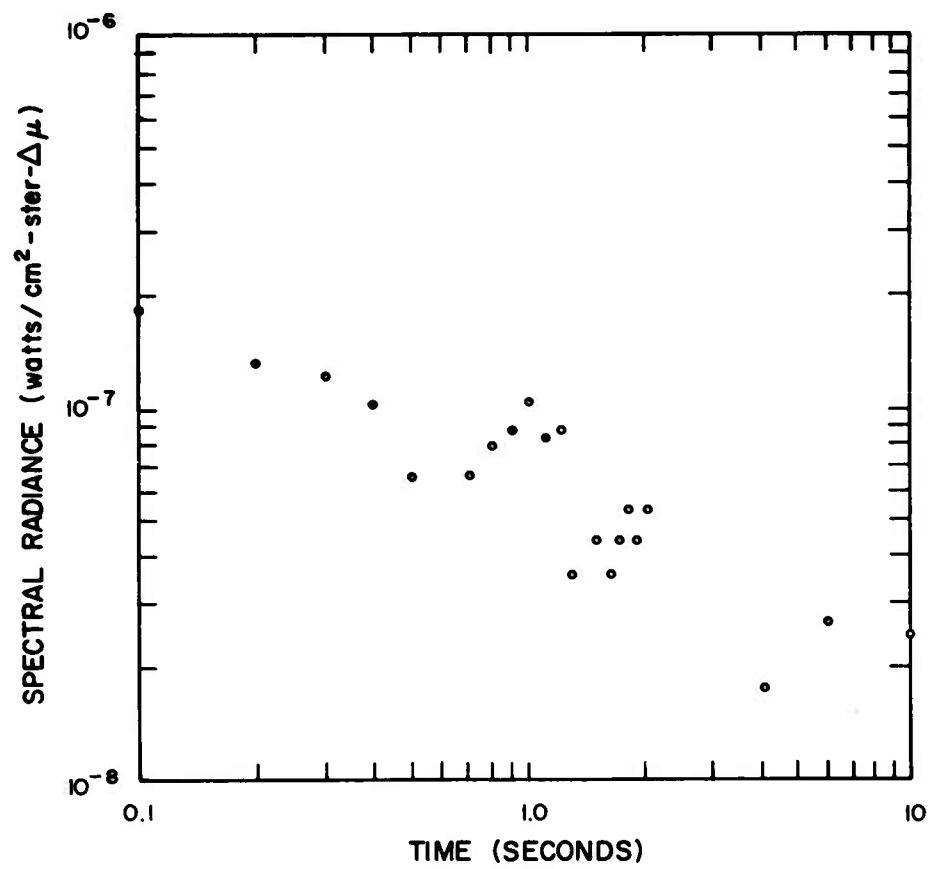


Figure 3.133 Spectral radiance, Kettle II, Check Mate, Channel 16, early time.



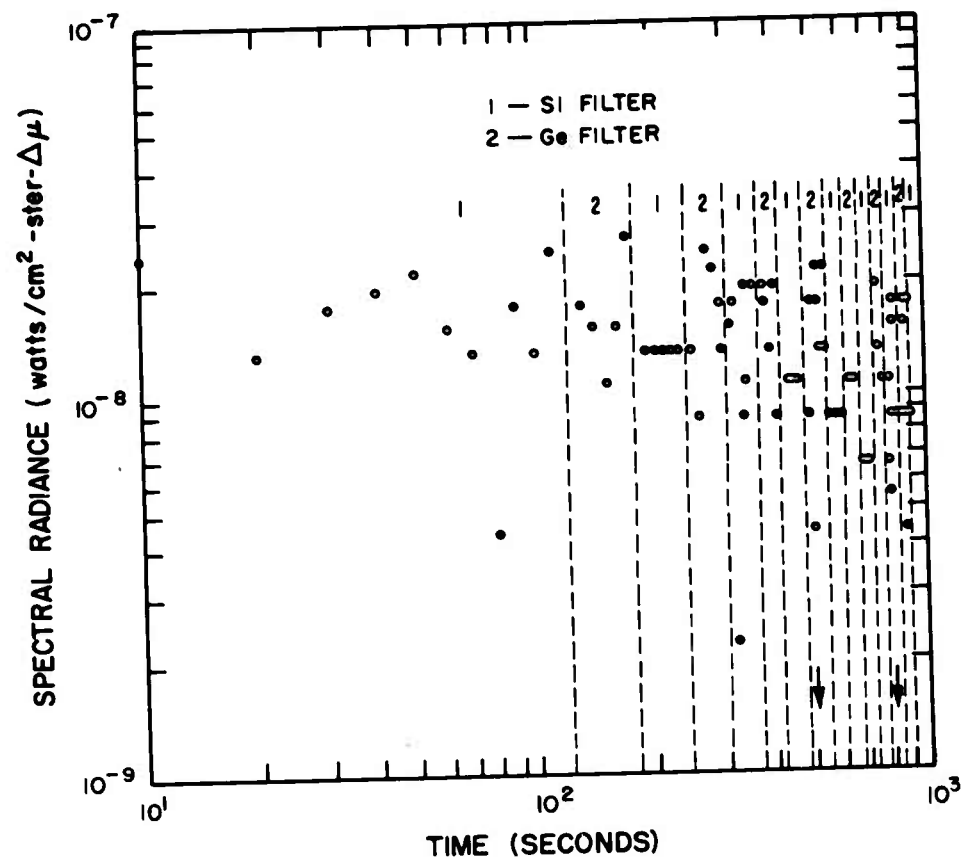


Figure 3.134 Spectral radiance, Kettle II, Check Mate, Channel 16, late time.

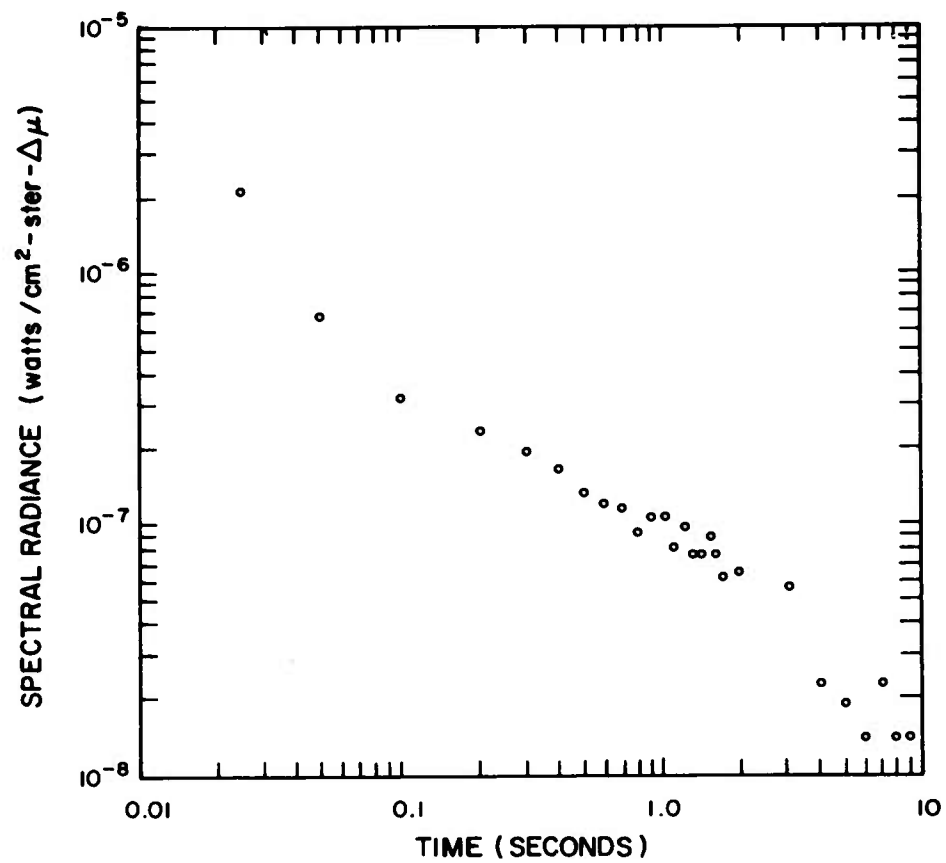


Figure 3.135 Spectral radiance, Kettle II, Check Mate, Channel 17, early time.

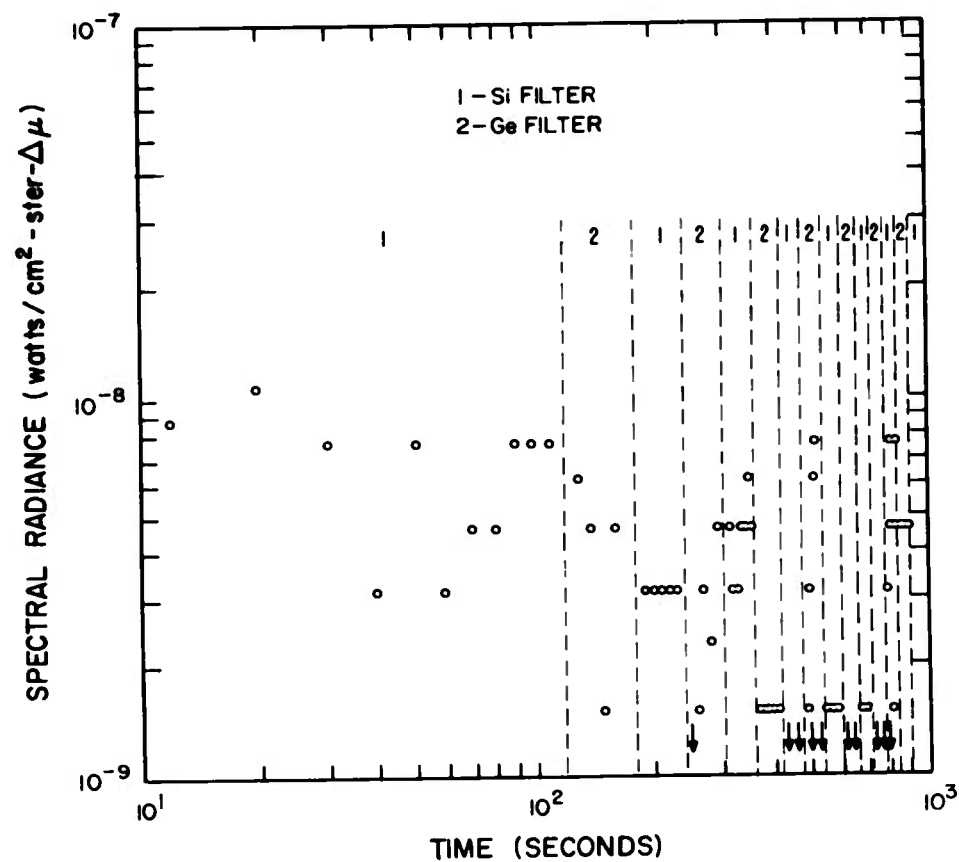


Figure 3.136 Spectral radiance, Kettle II, Check Mate, Channel 17, late time.

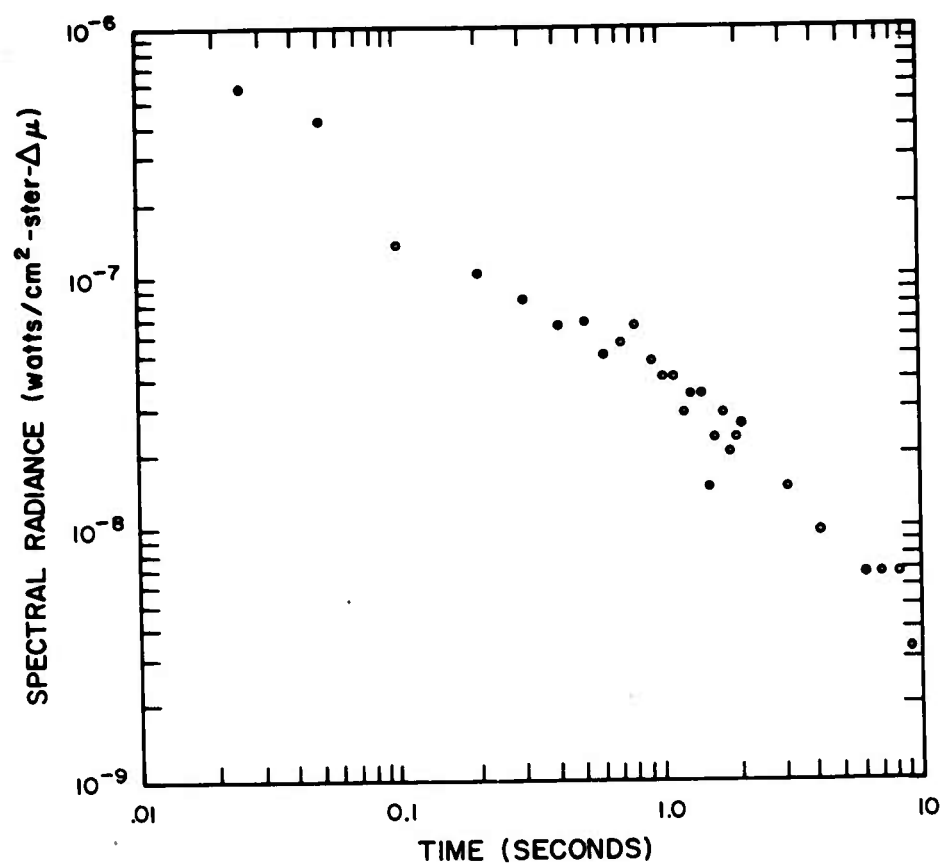


Figure 3.137 Spectral radiance, Kettle II, Check Mate, Channel 18, early time.

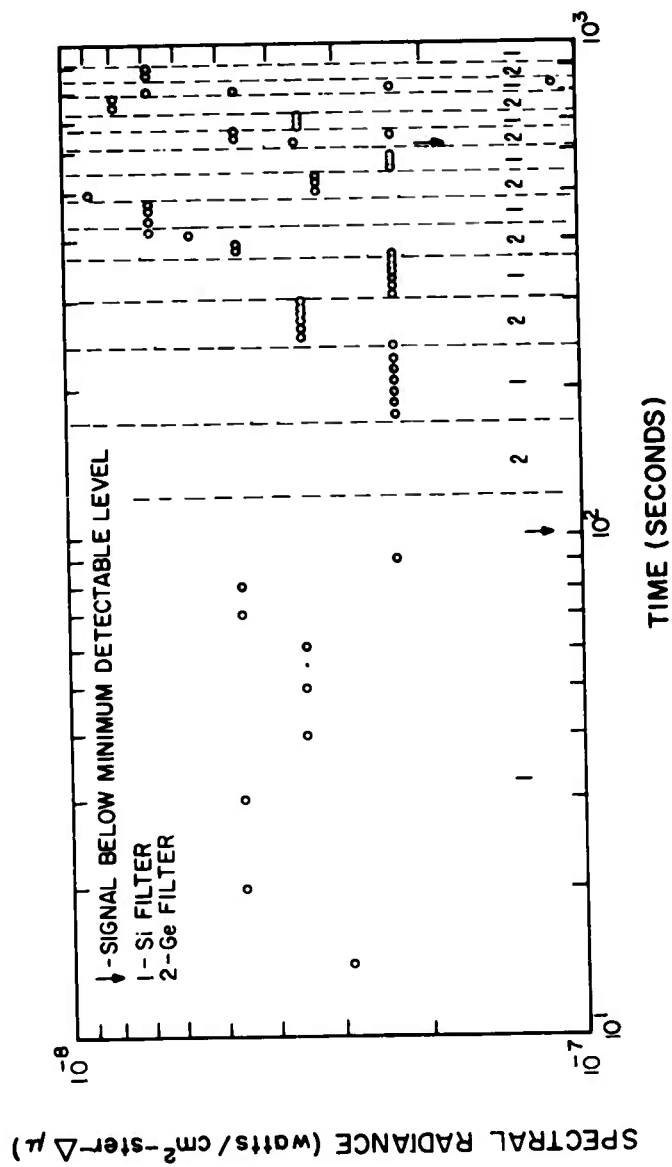


Figure 3.138 Spectral radiance, Kettle II, Check Mate, Channel 18, late time.

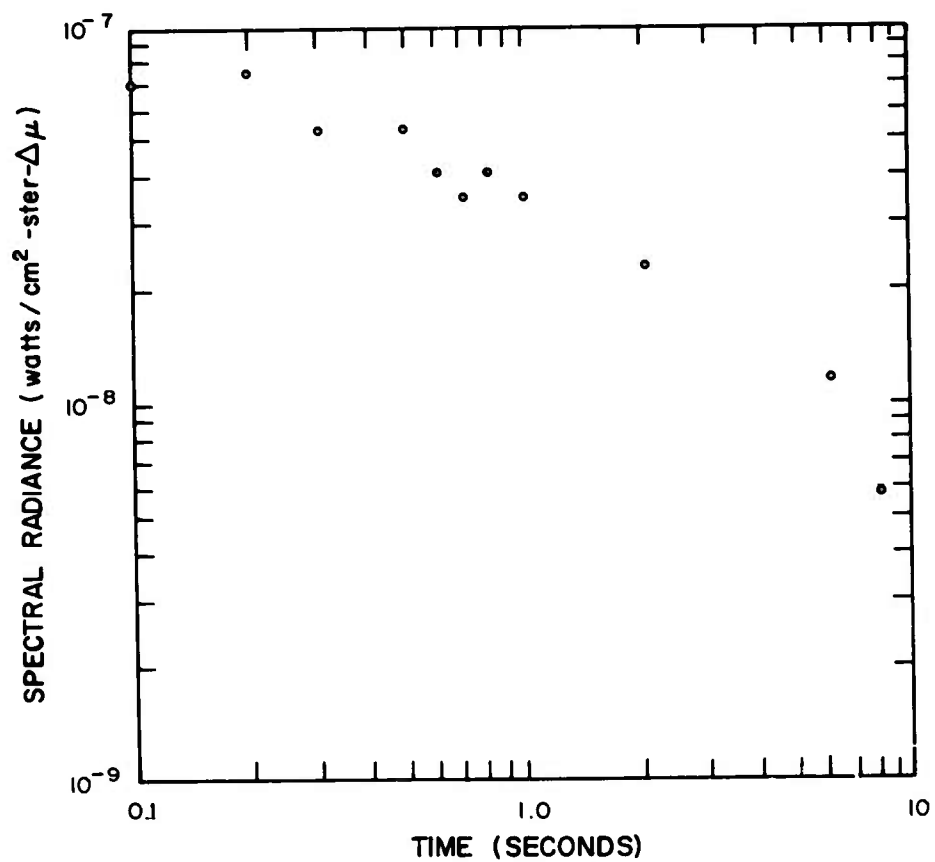


Figure 3.139 Spectral radiance, Kettle II, Check Mate, Channel 19, early time.

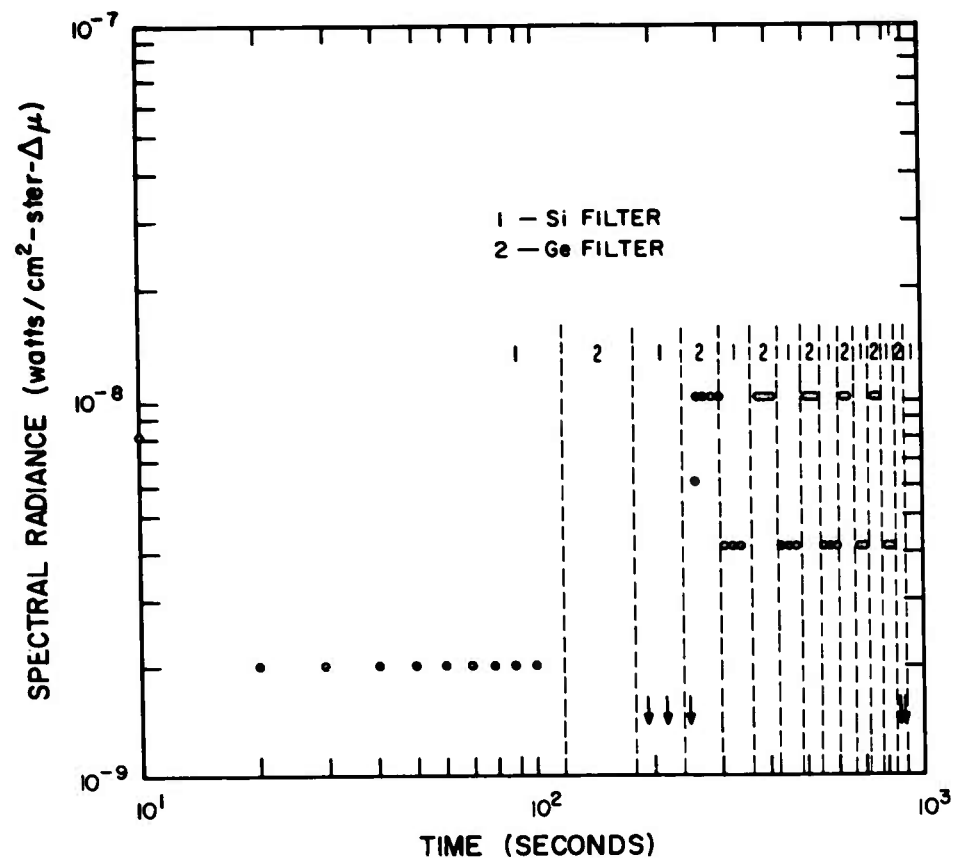


Figure 3.140 Spectral radiance, Kettle II, Check Mate, Channel 19, late time.

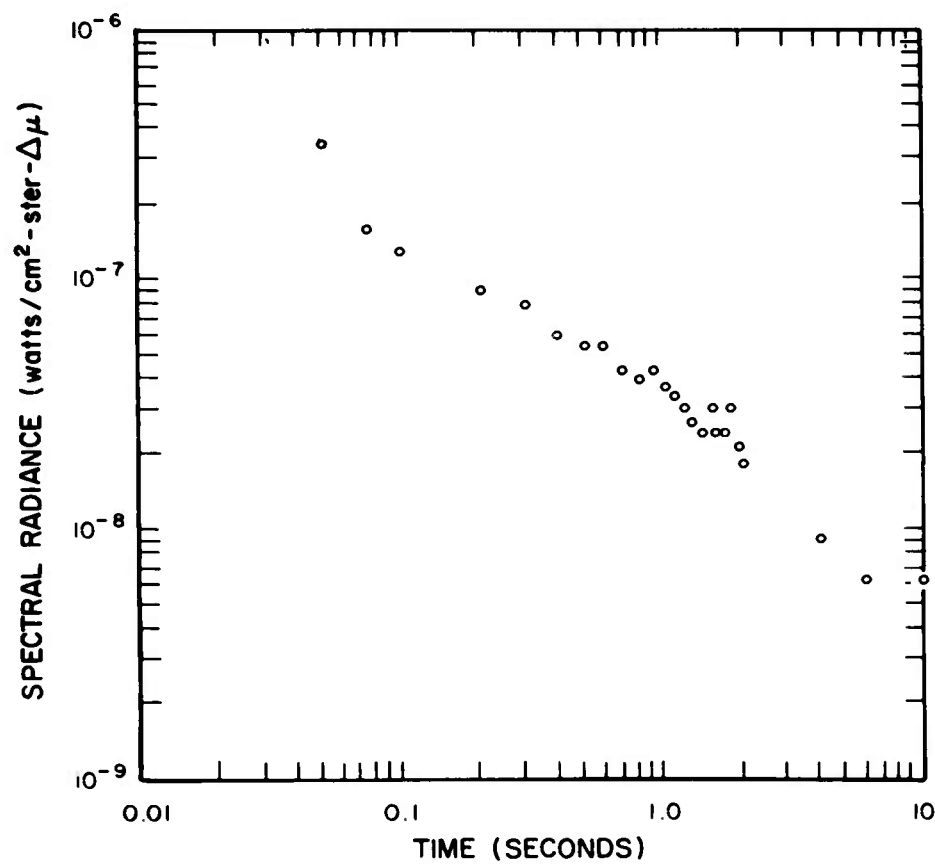


Figure 3.141 Spectral radiance, Kettle II, Check Mate, Channel 20, early time.



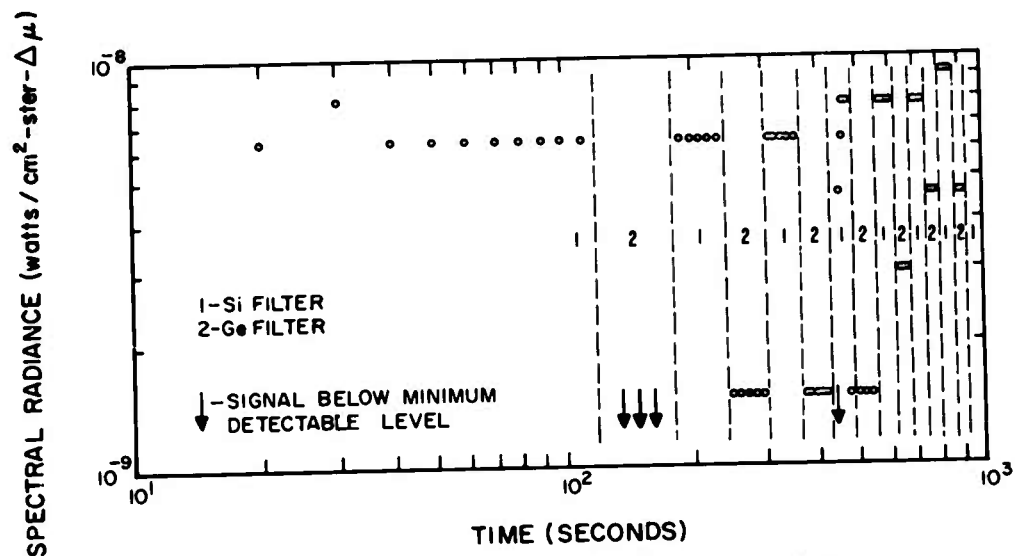


Figure 3.142 Spectral radiance, Kettle II, Check Mate, Channel 20, late time.

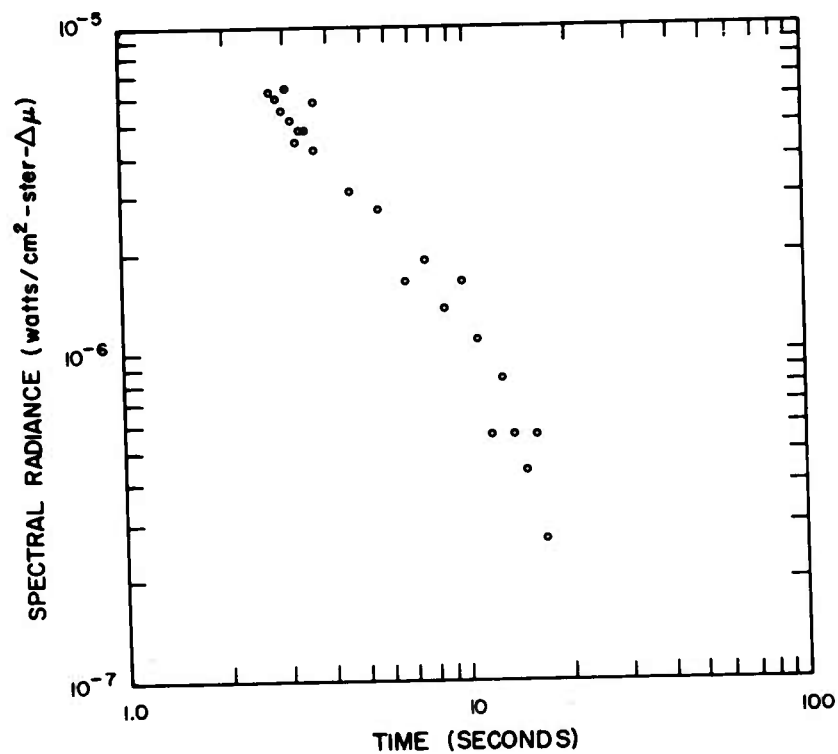


Figure 3.143 Spectral radiance, Kettle II, Check Mate, Channel 21.

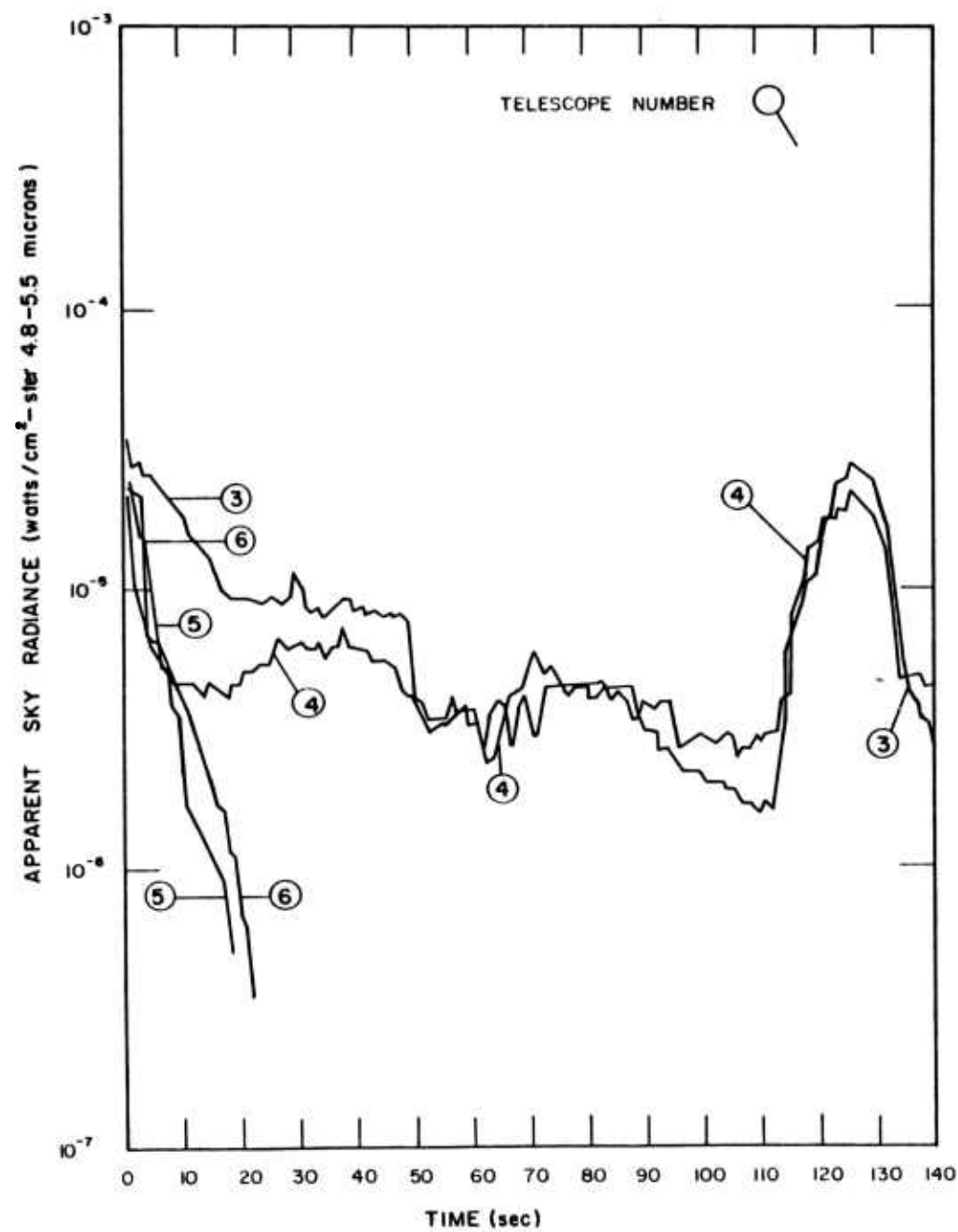


Figure 3.144 5.0-micron data, Check Mate.

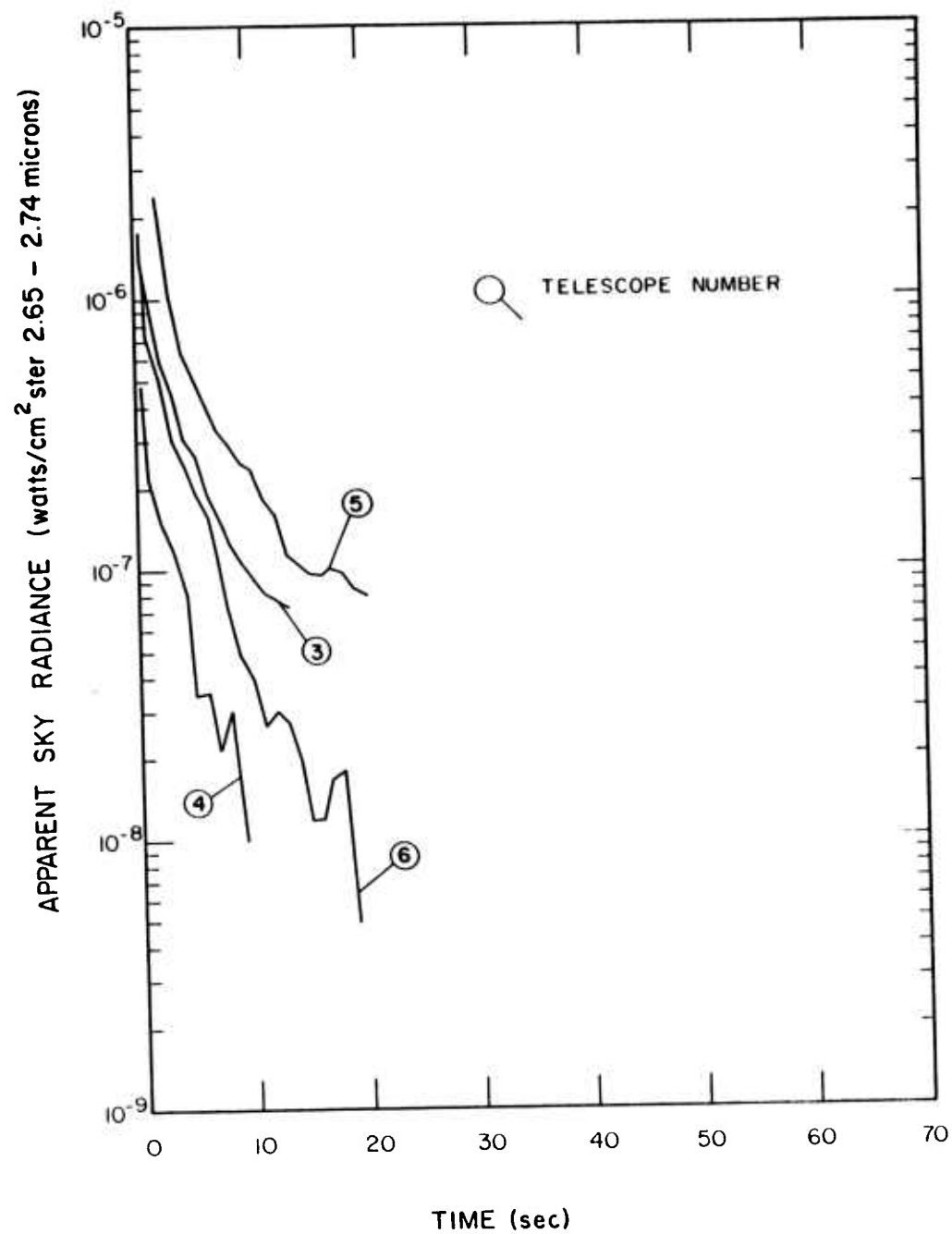


Figure 3.145 2.7-micron data, Check Mate.

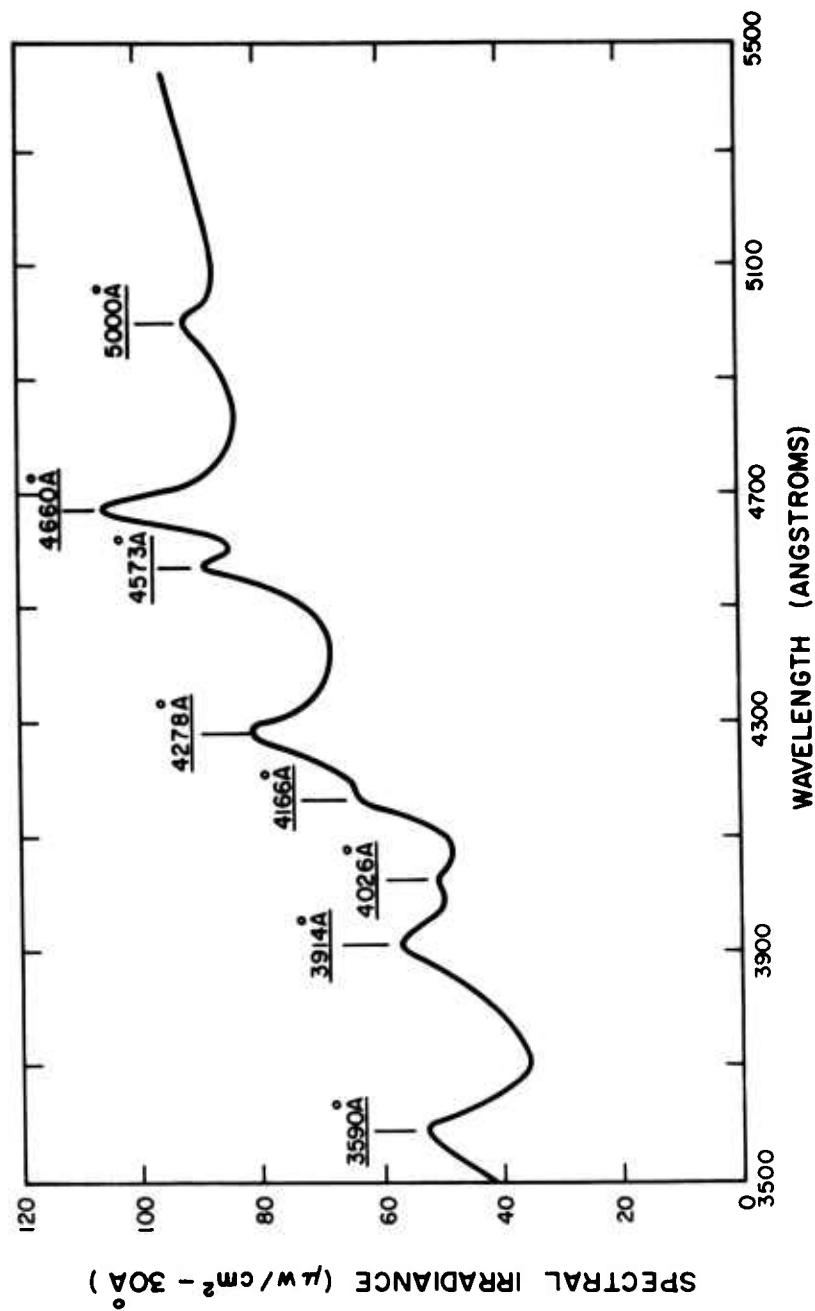


Figure 3.146 Spectrogram at H + 12 msec, Kettle I, Check Mate.

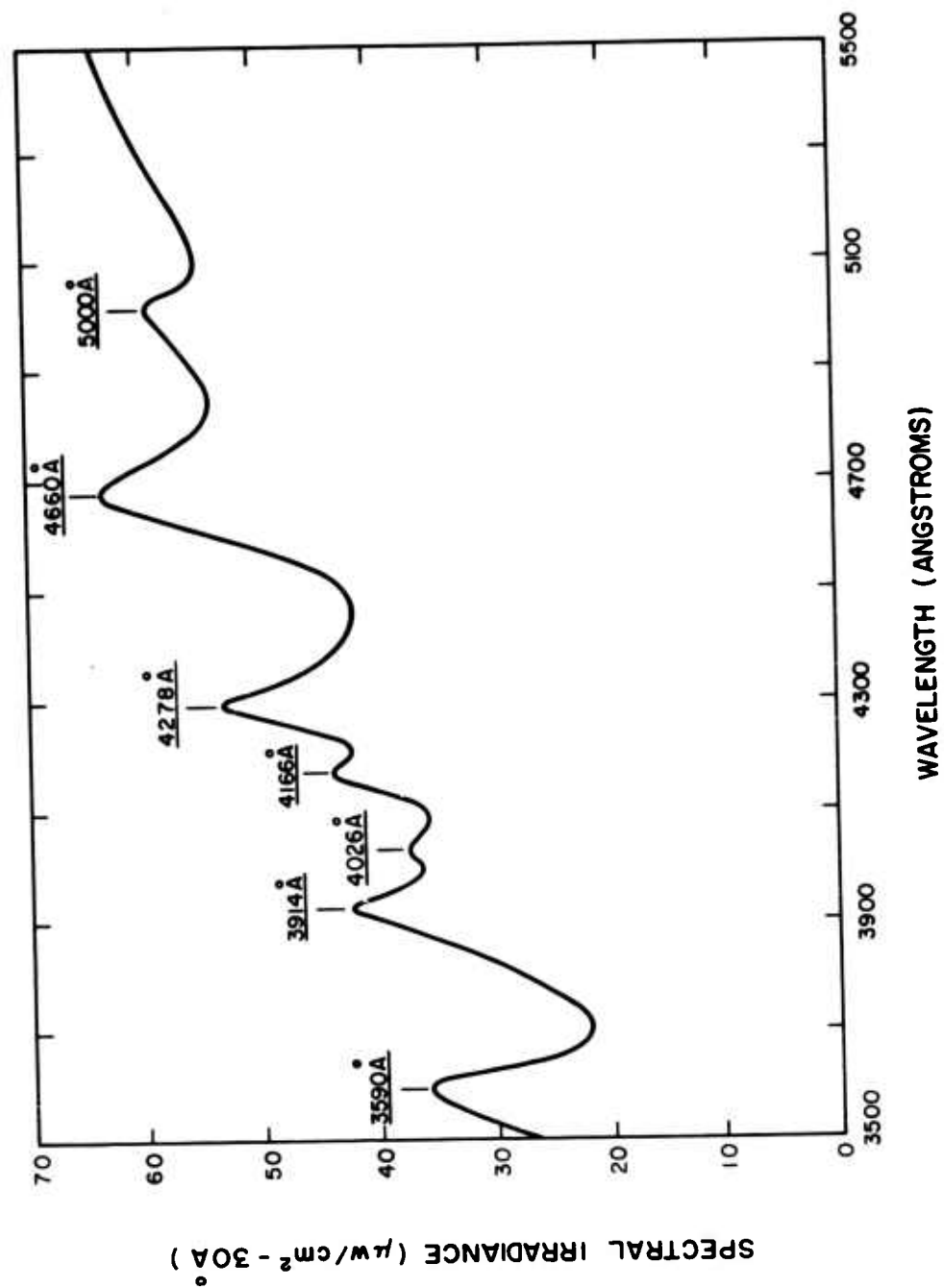


Figure 3.147 Spectrogram at H + 17 msec, Kettle I, Check Mate.

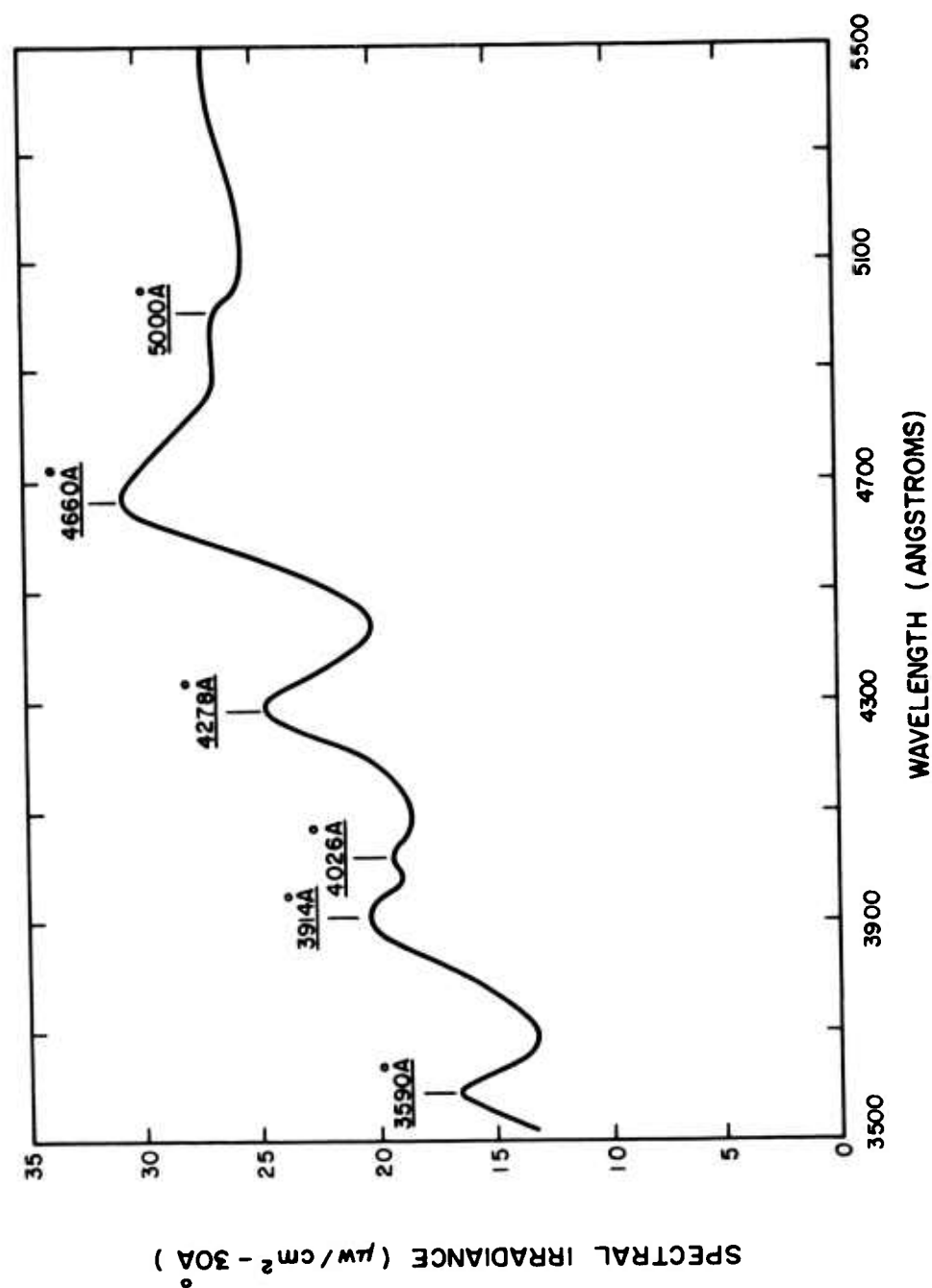


Figure 3.148 Spectrogram at H + 26 msec. Kettle I, Check Mate.

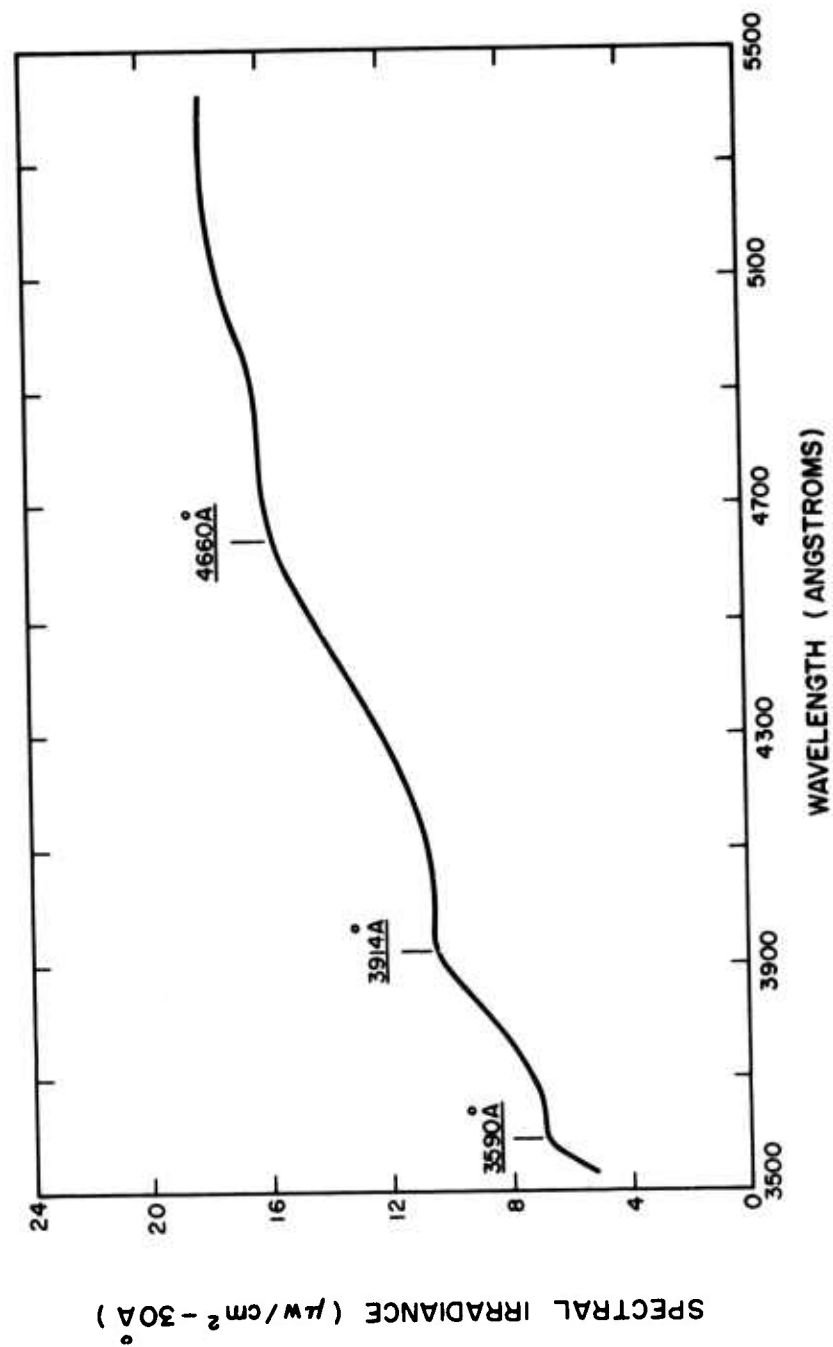


Figure 3.149 Spectrogram at H + 50 msec, Kettle I, Check Mate.

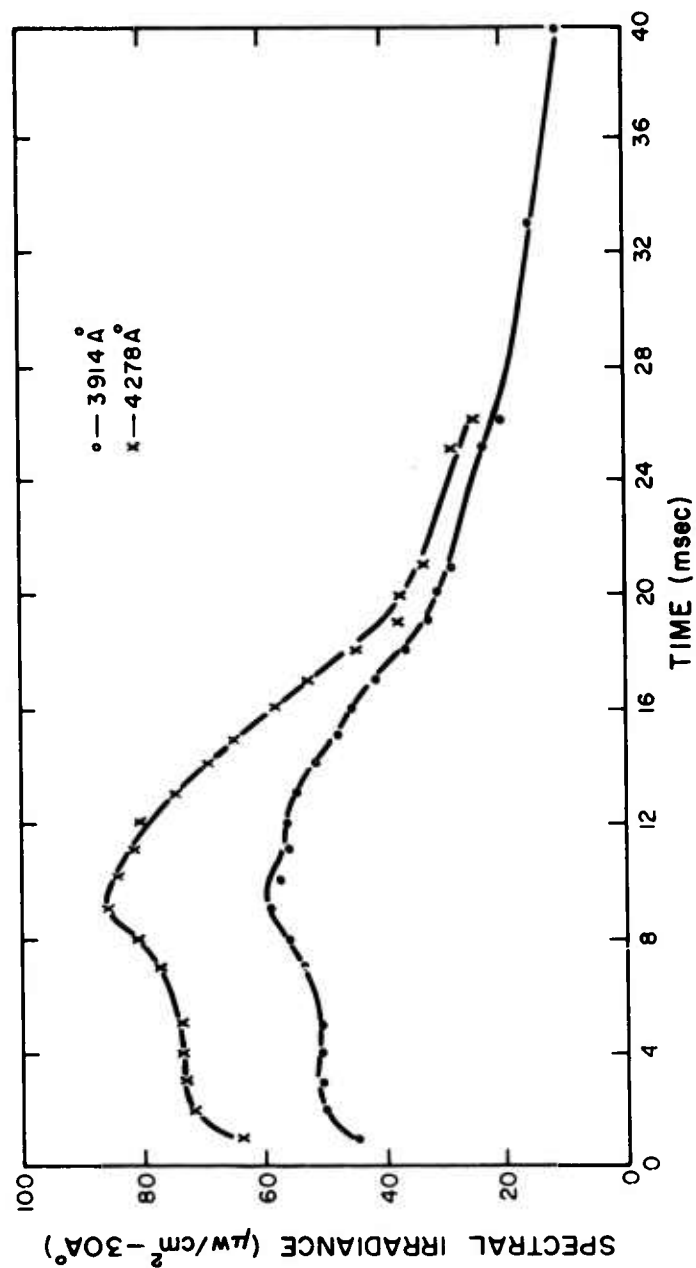


Figure 3.150 Decay of spectral irradiance at two wavelengths,  
Kettle I, Check Mate.



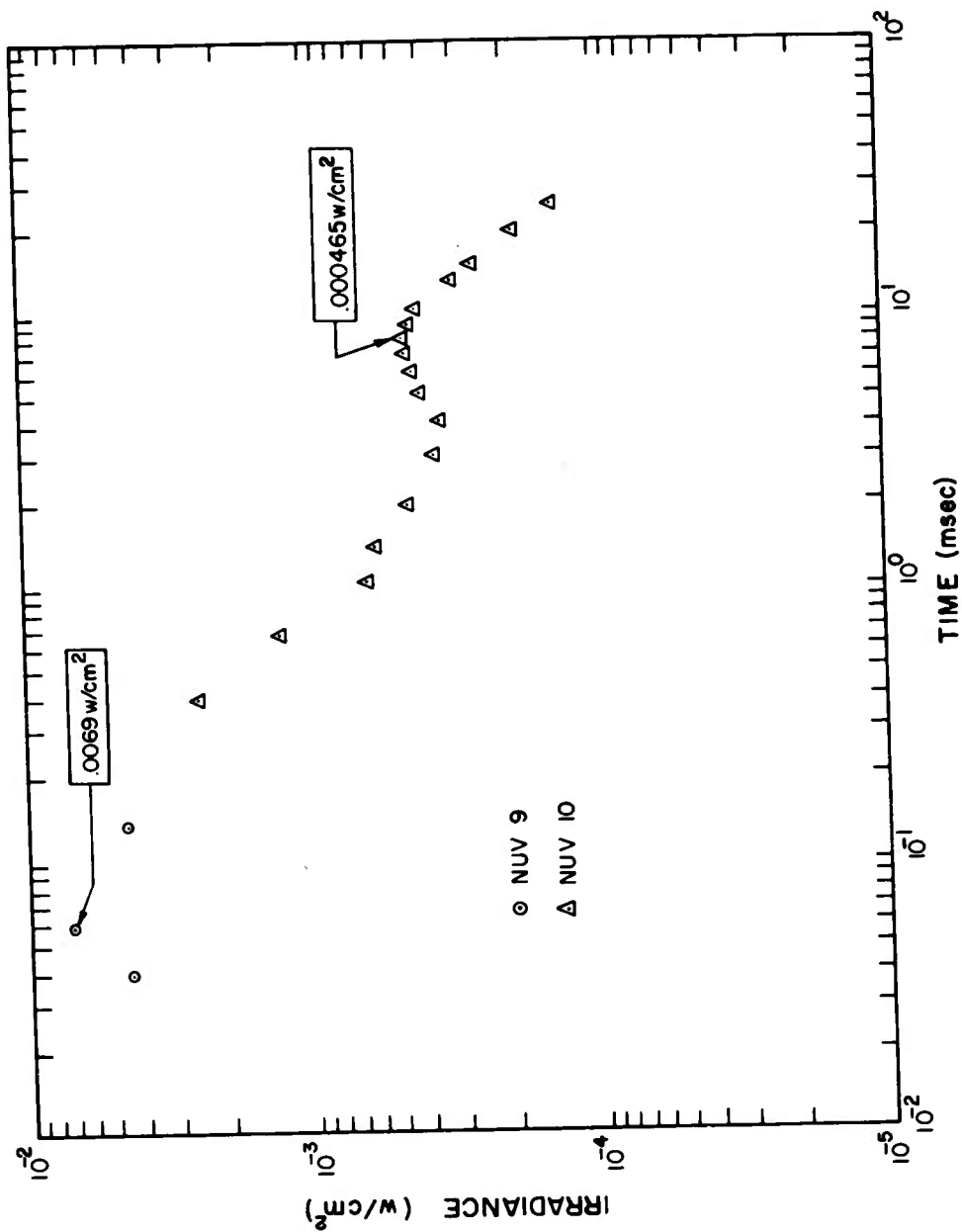


Figure 3.151 Irradiance, Kettle I, Check Mate, in spectral region 0.29 to 0.40  $\mu$ .

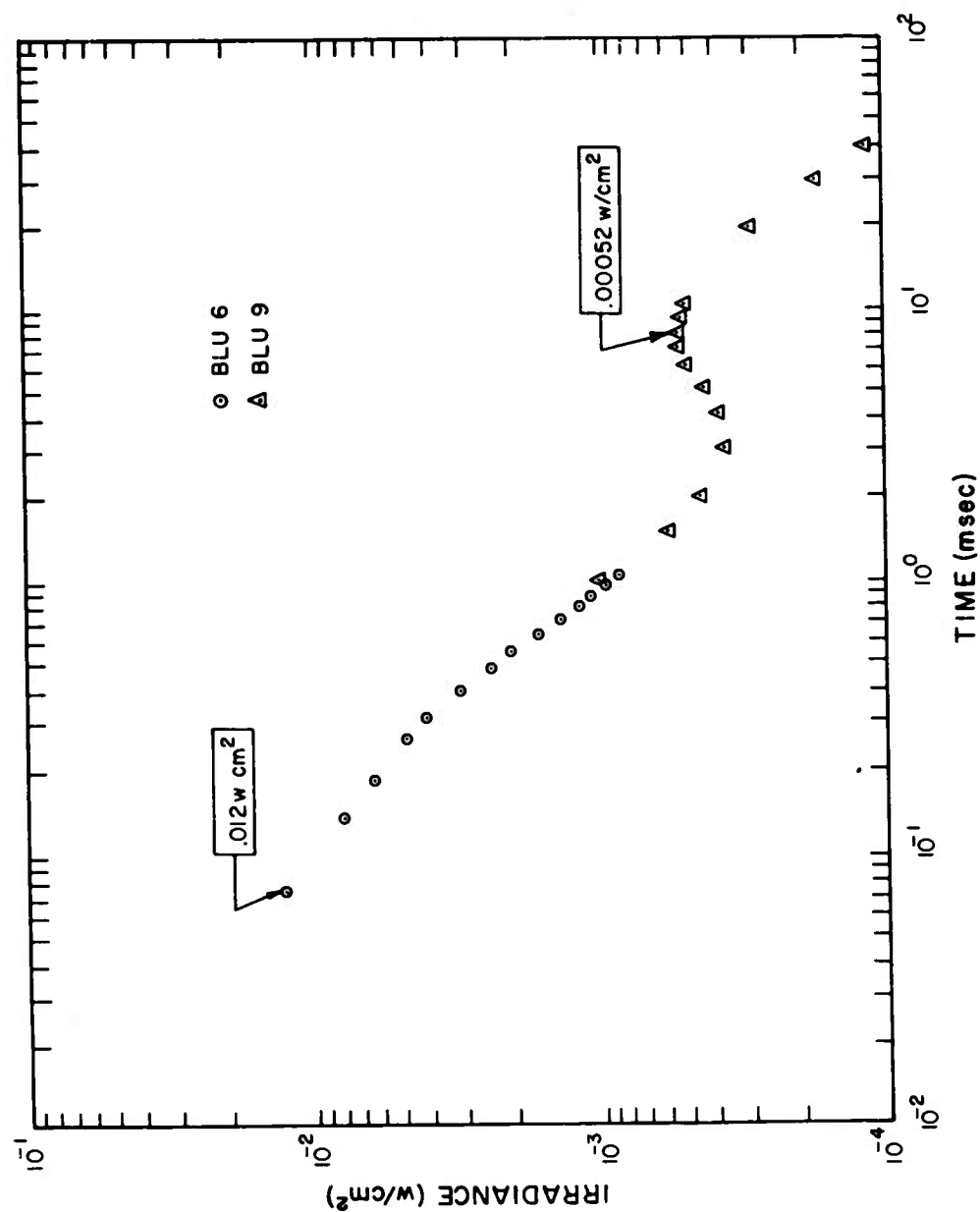


Figure 3.152 Irradiance, Kettle I, Check Mate, in spectral region 0.40 to 0.50  $\mu$ .

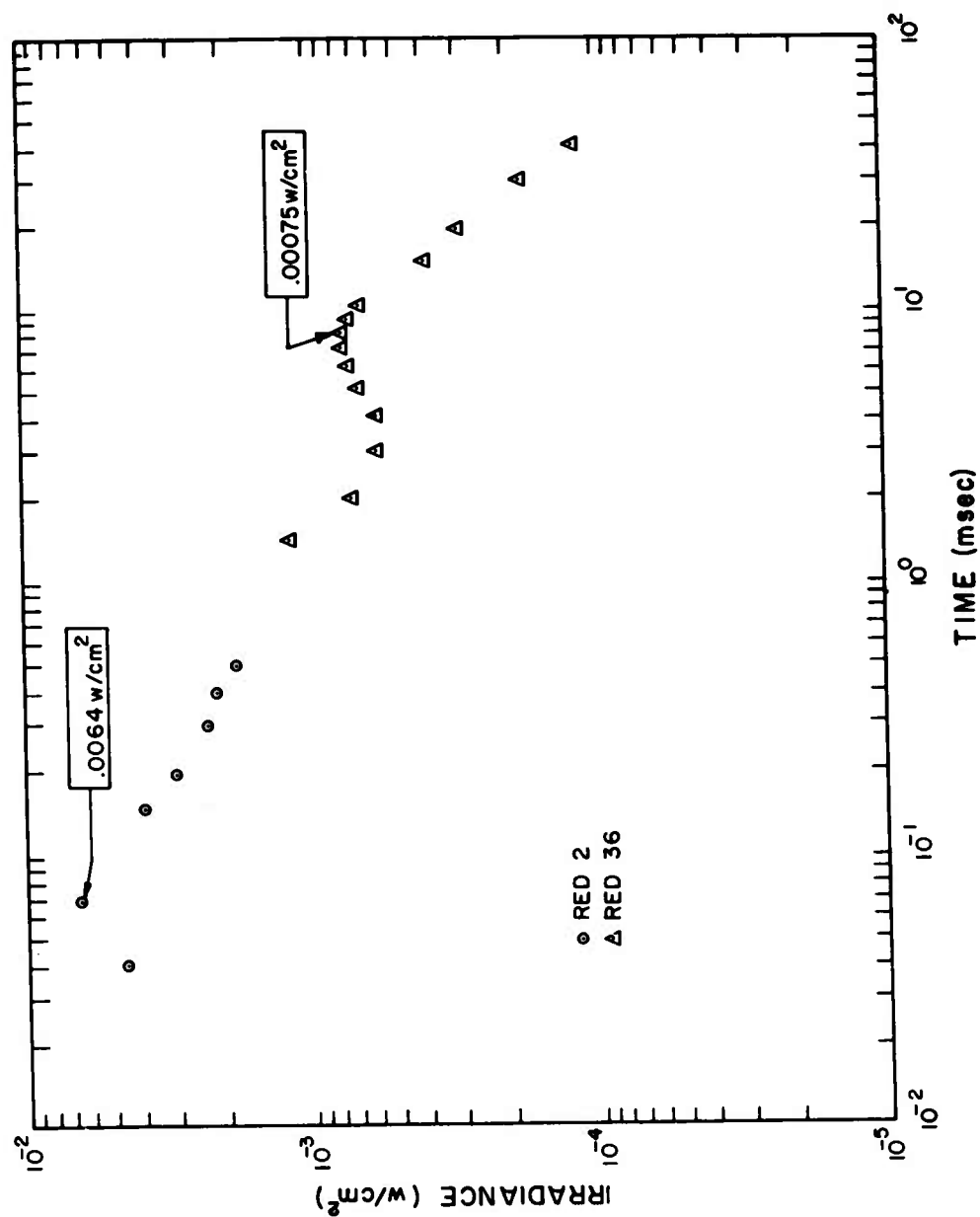


Figure 3.153 Irradiance, Kettle I, Check Mate, in spectral region 0.50 to 0.74  $\mu$ .

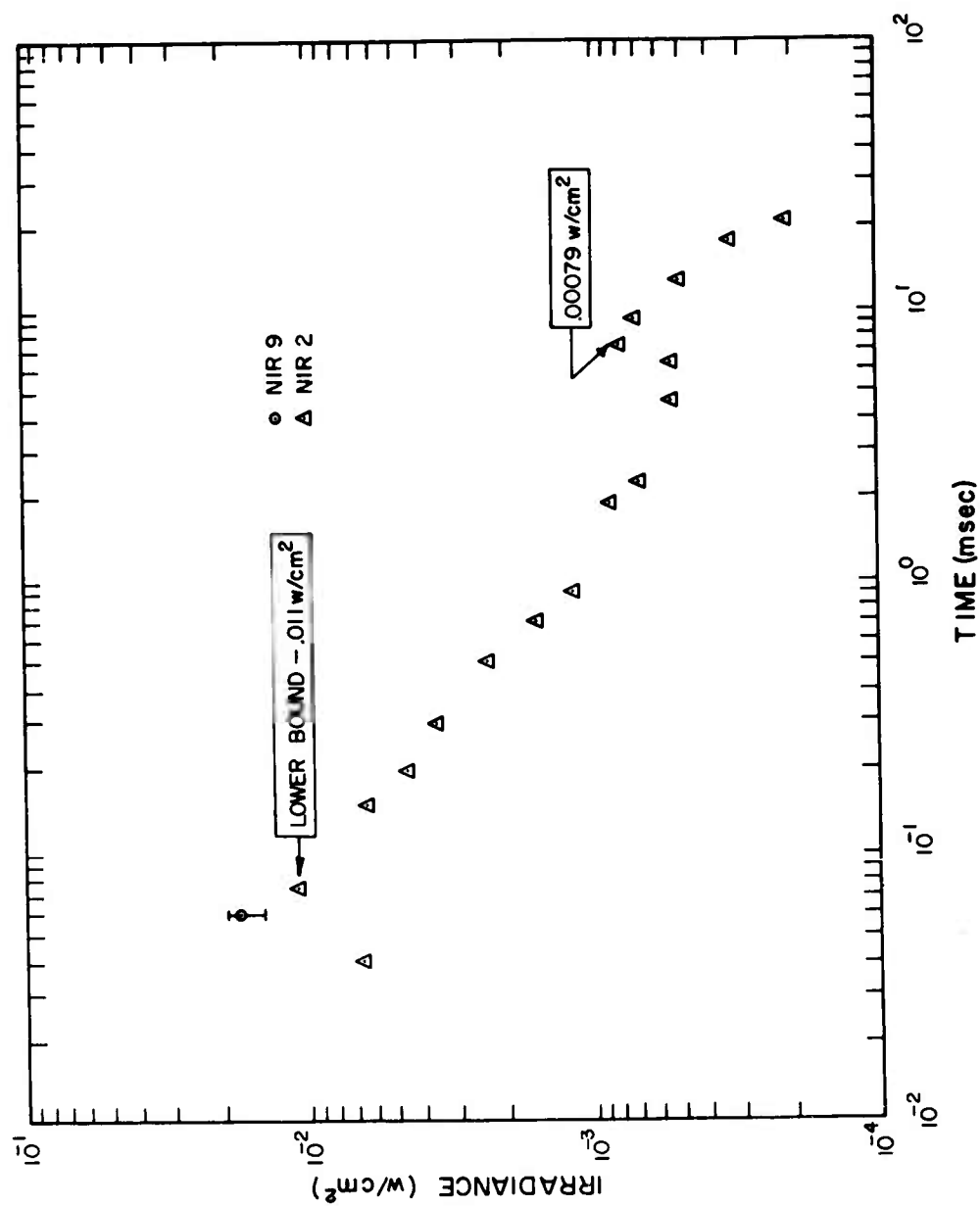


Figure 3.154 Irradiance, Kettle I, Check Mate, in spectral region 0.75 to 1.0  $\mu$ .

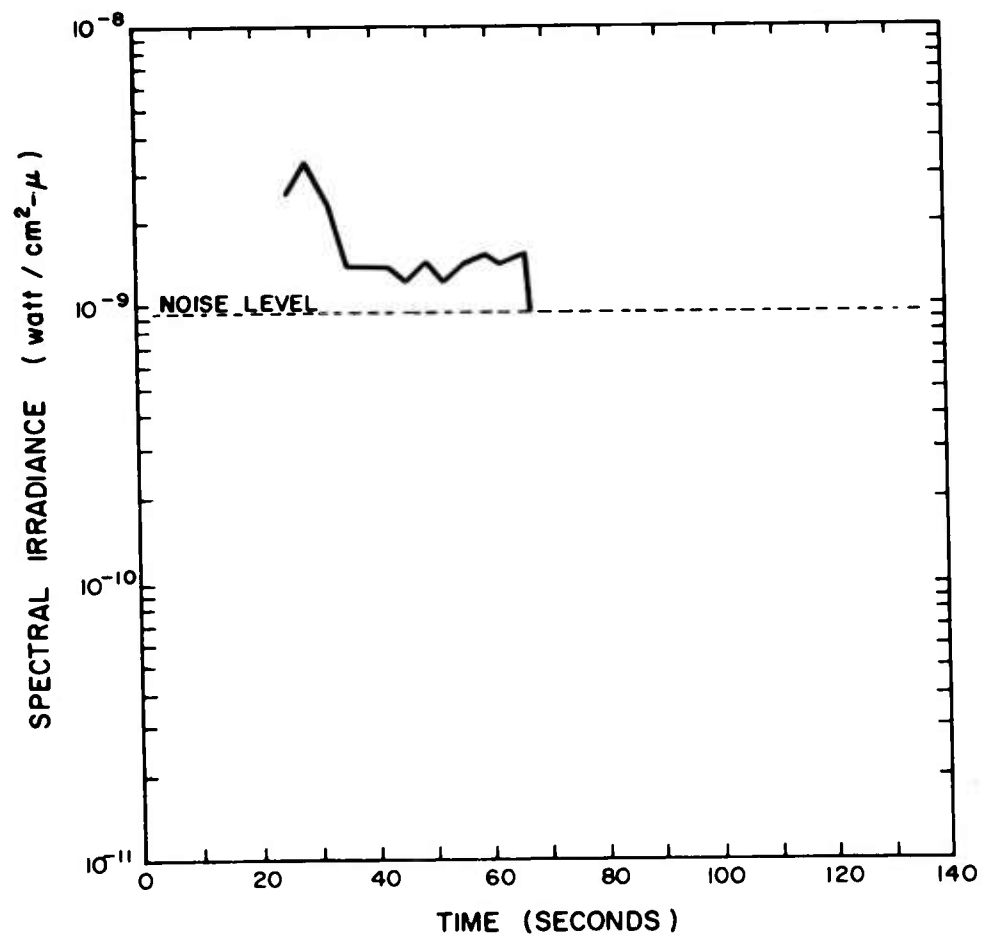


Figure 3.155 Irradiance, Kettle I, Check Mate, in spectral region 1.55 to 1.615 μ.

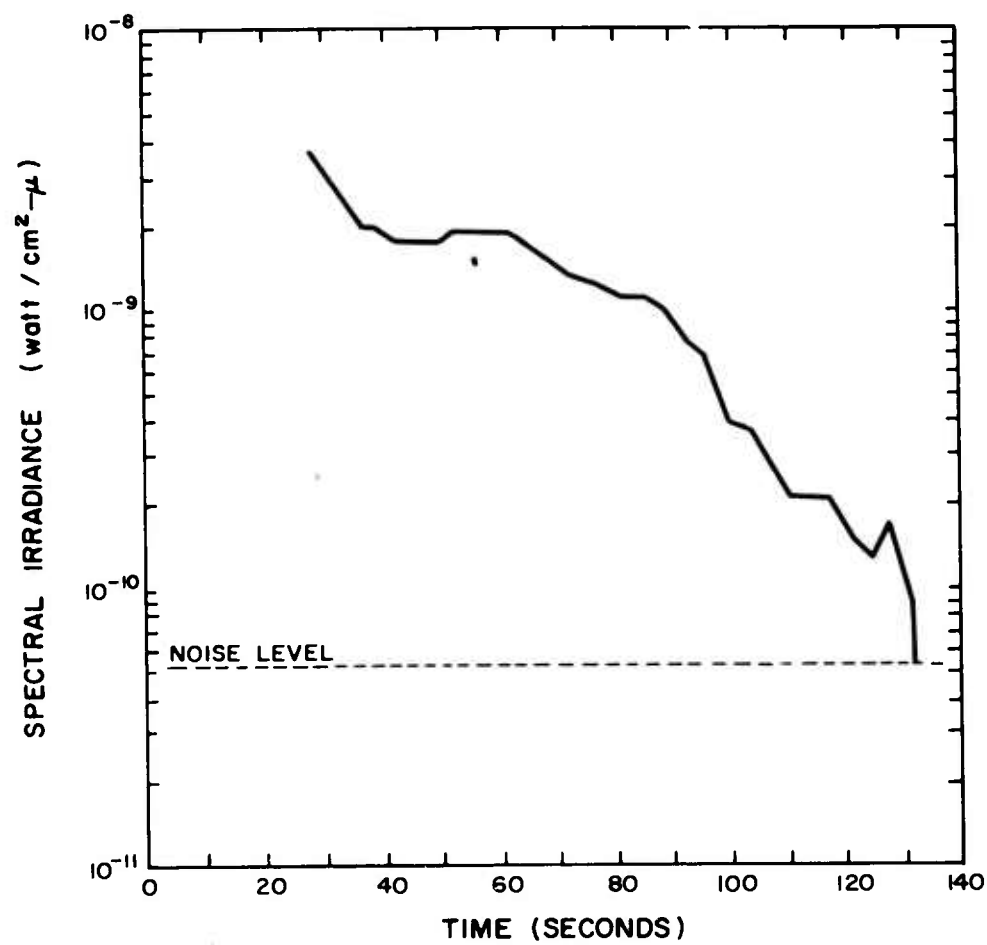


Figure 3.156 Irradiance, Kettle I, Check Mate, in spectral region 1.61 to 1.93  $\mu$ .

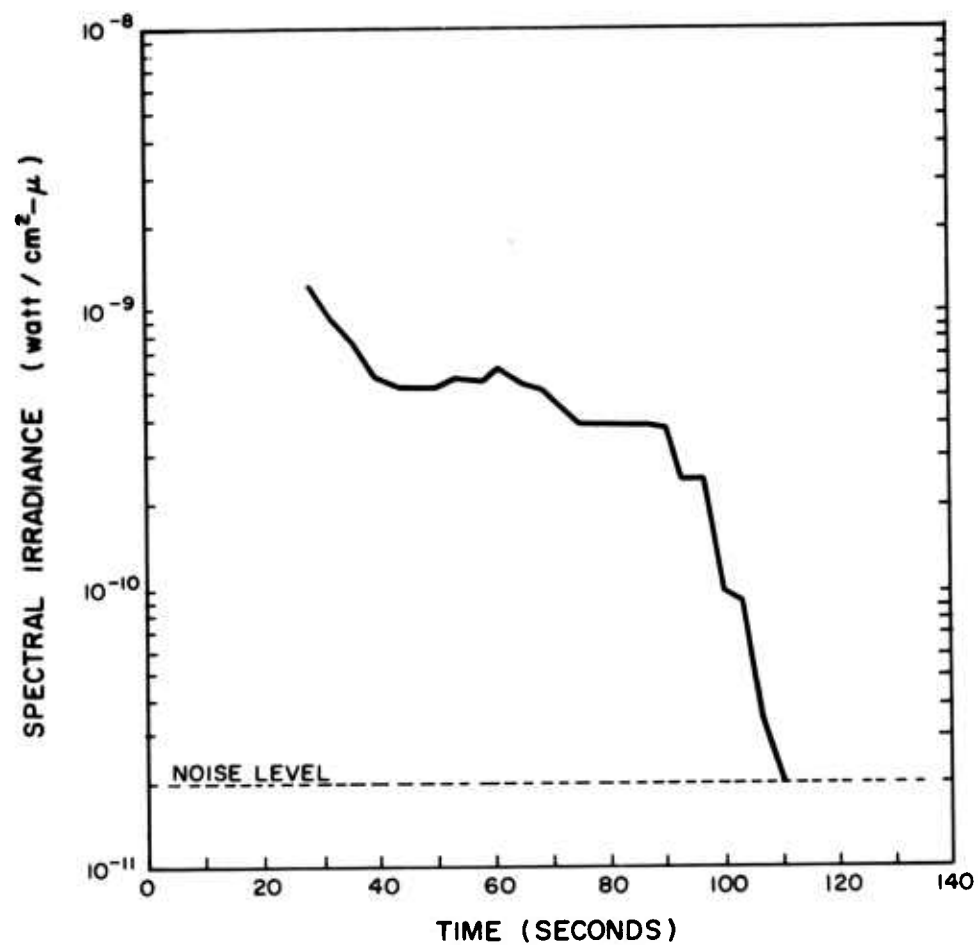


Figure 3.157 Irradiance, Kettle I, Check Mate, in spectral region 1.87 to 2.56  $\mu$ .

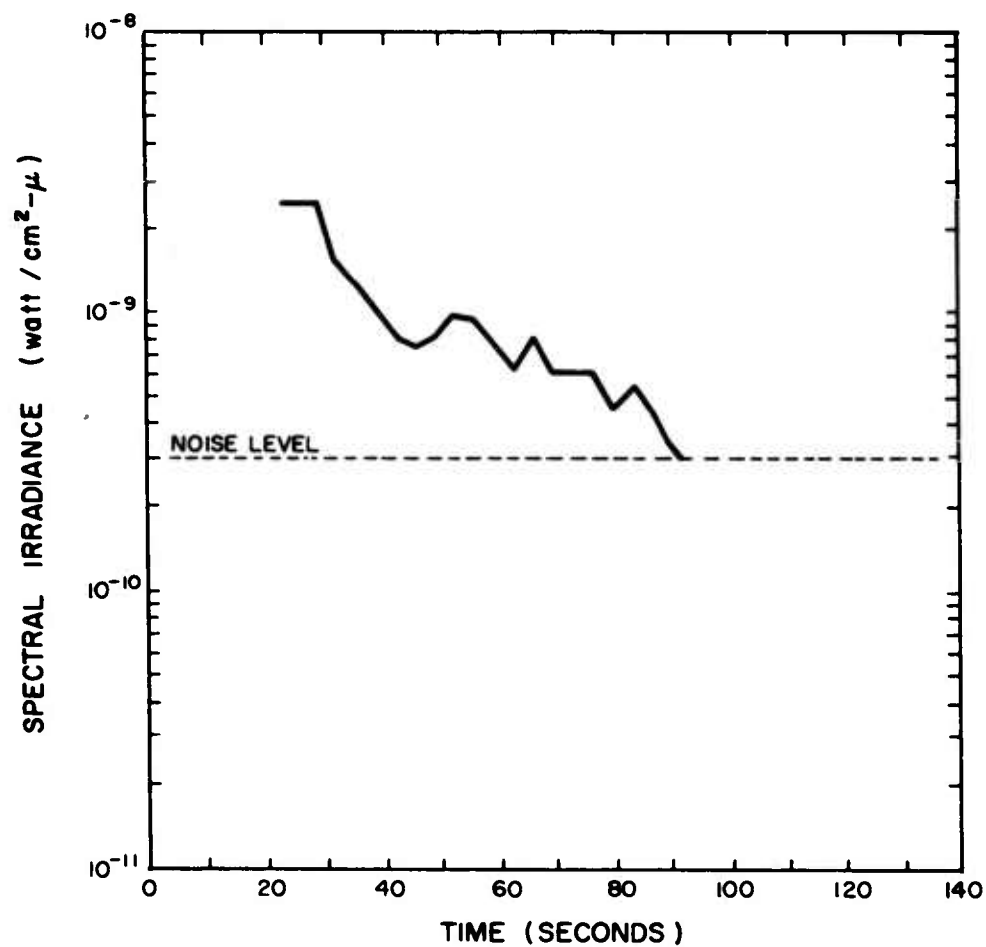


Figure 3.158 Irradiance, Kettle I, Check Mate, in spectral region 2.15 to 2.21  $\mu$ .



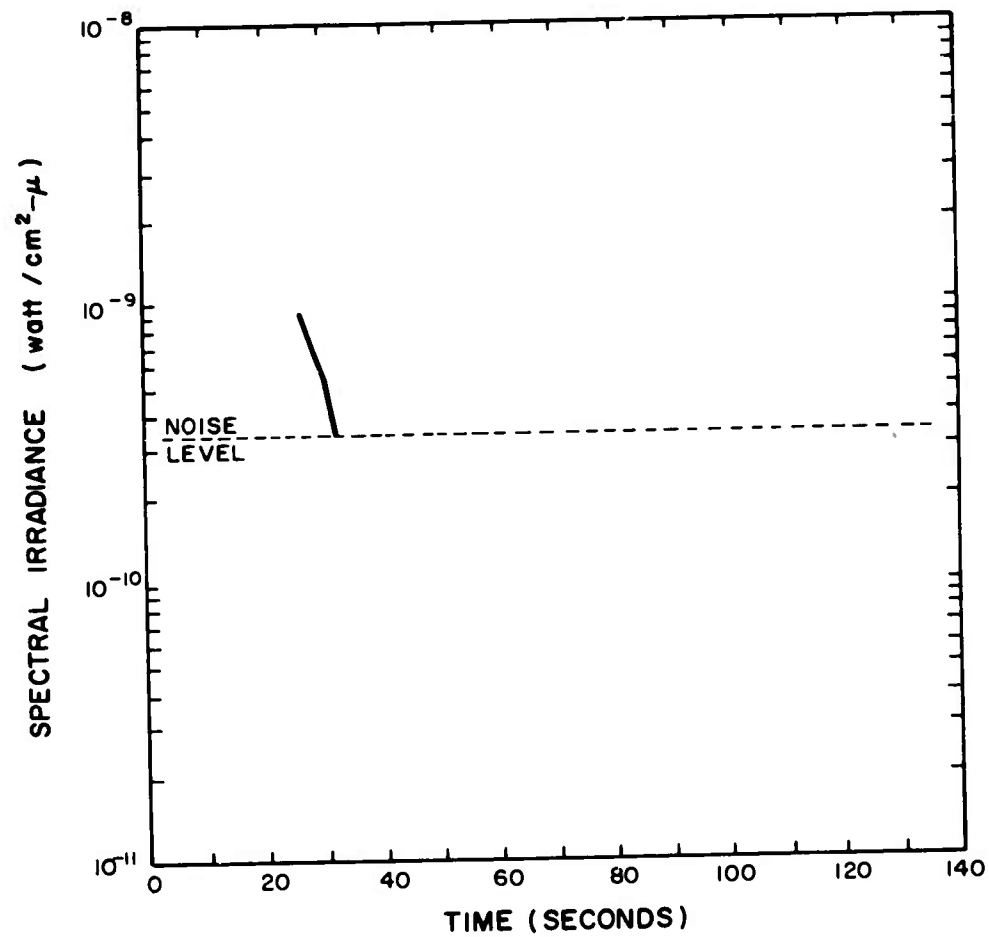


Figure 3.159 Irradiance, Kettle I, Check Mate, in spectral region 2.645 to 2.72  $\mu$ .

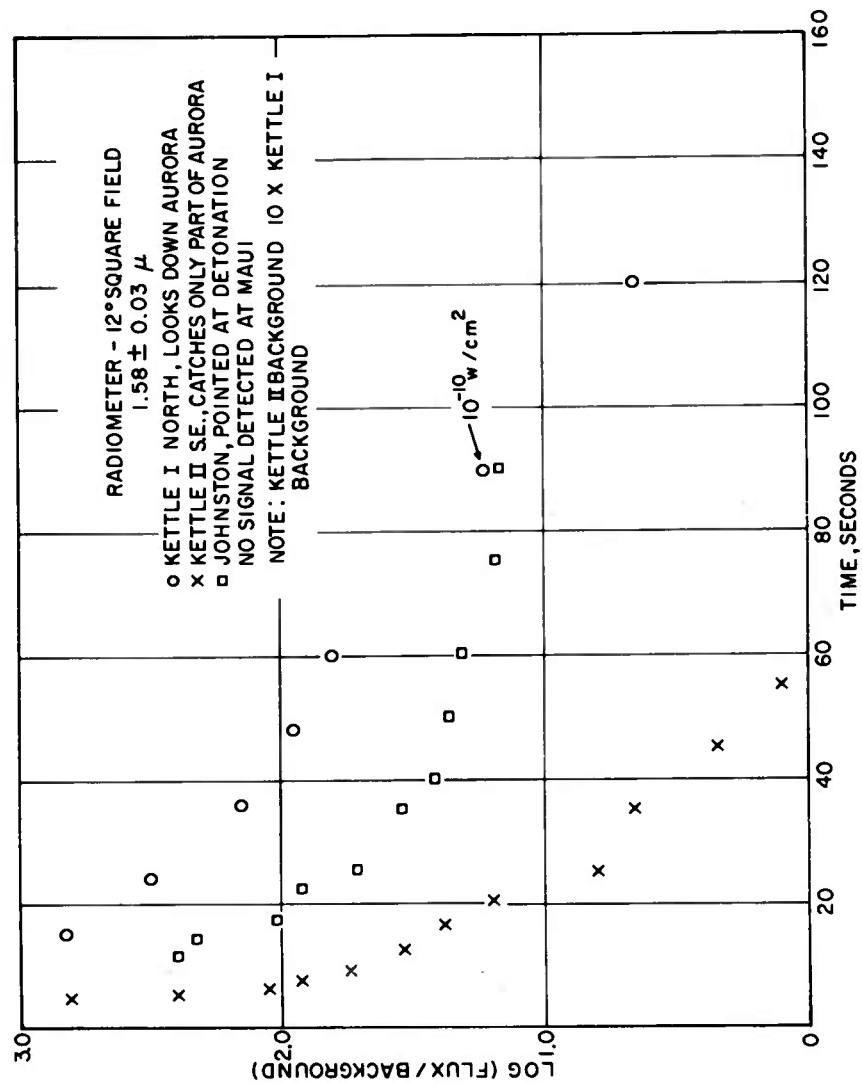


Figure 3.160 PbS radiometer results from aircraft stations and Johnston Island, Check Mate.

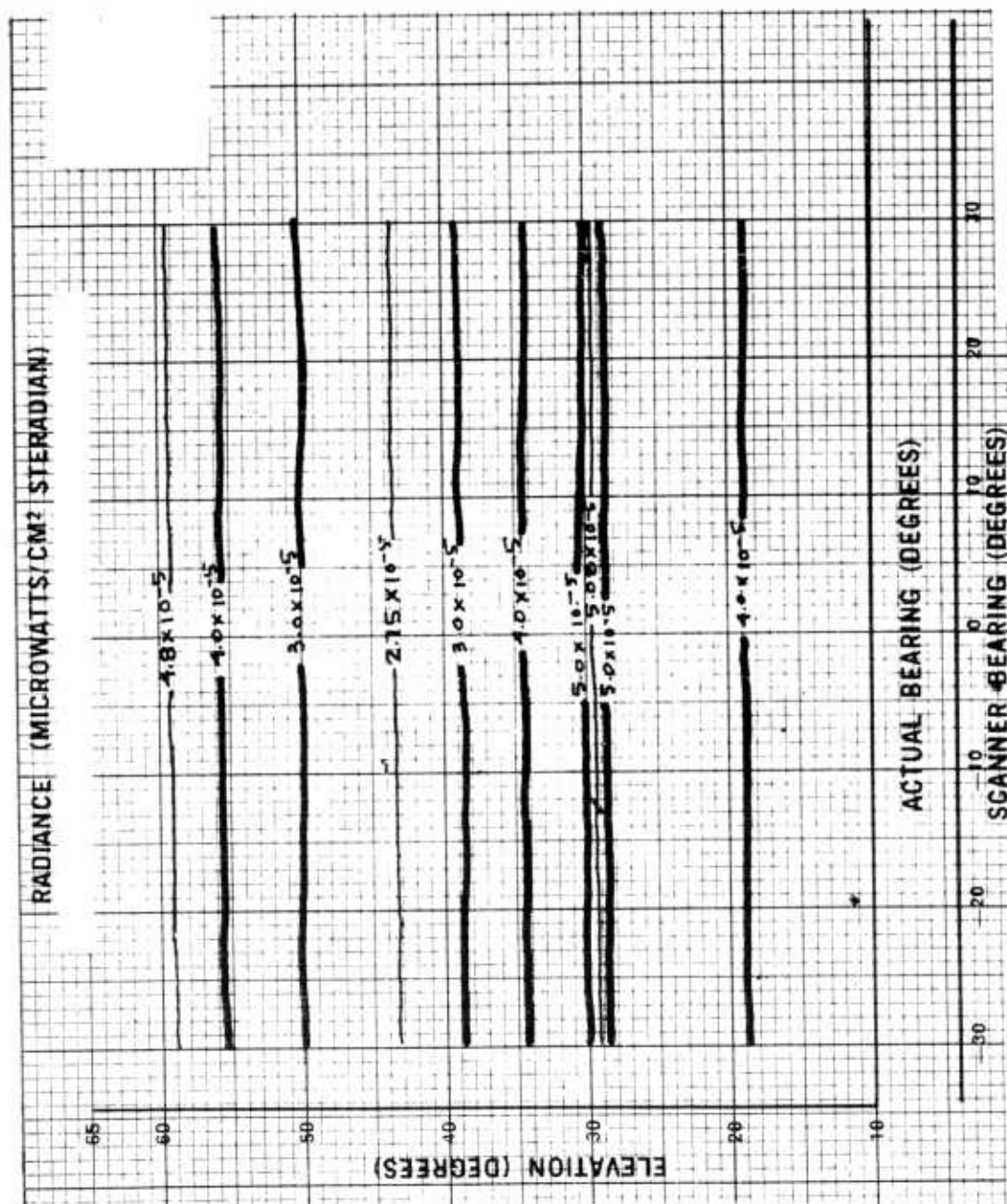


Figure 3.161 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H-162 seconds.

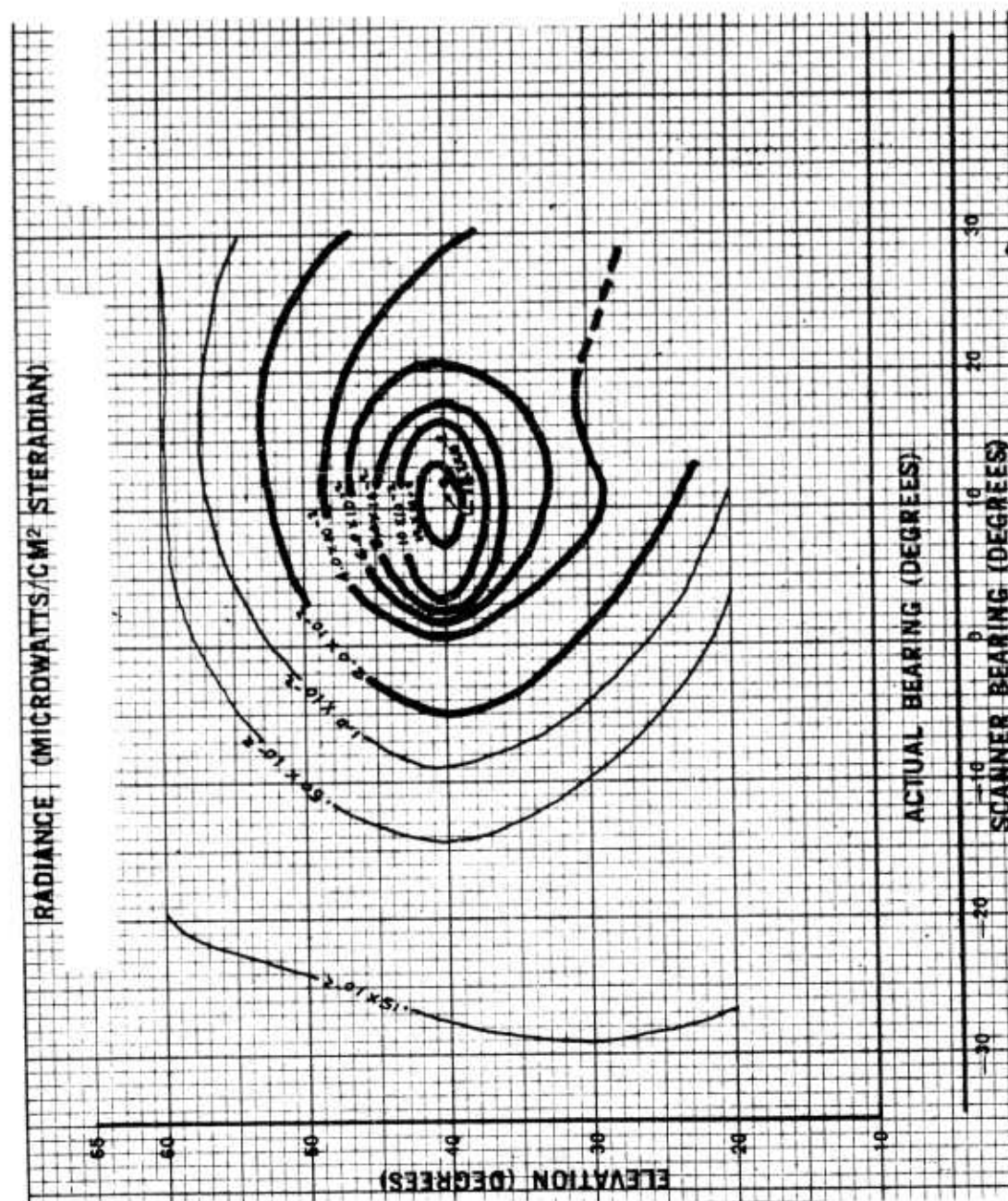


Figure 3.162 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 41 seconds.

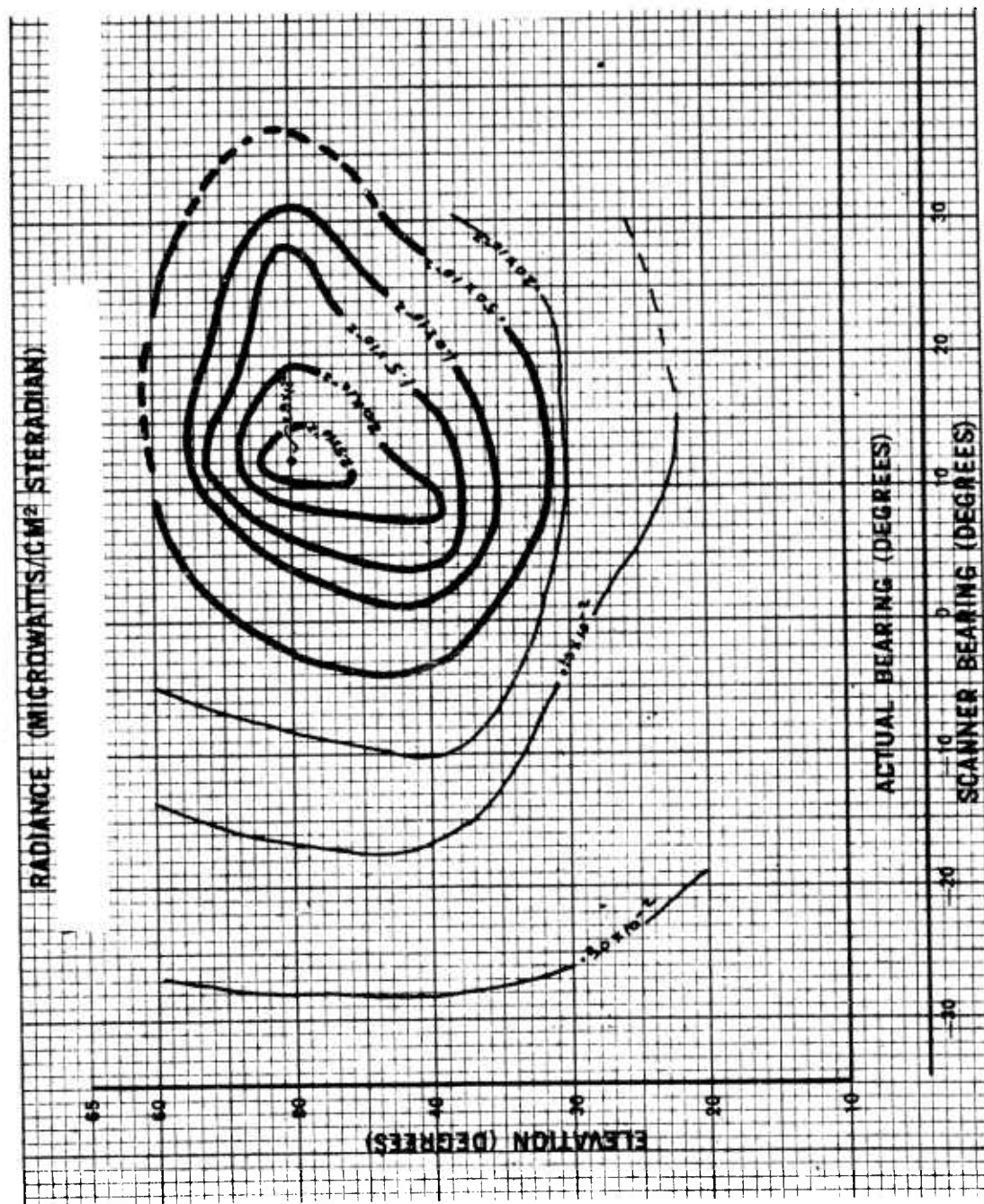


Figure 3.163 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 109 seconds.





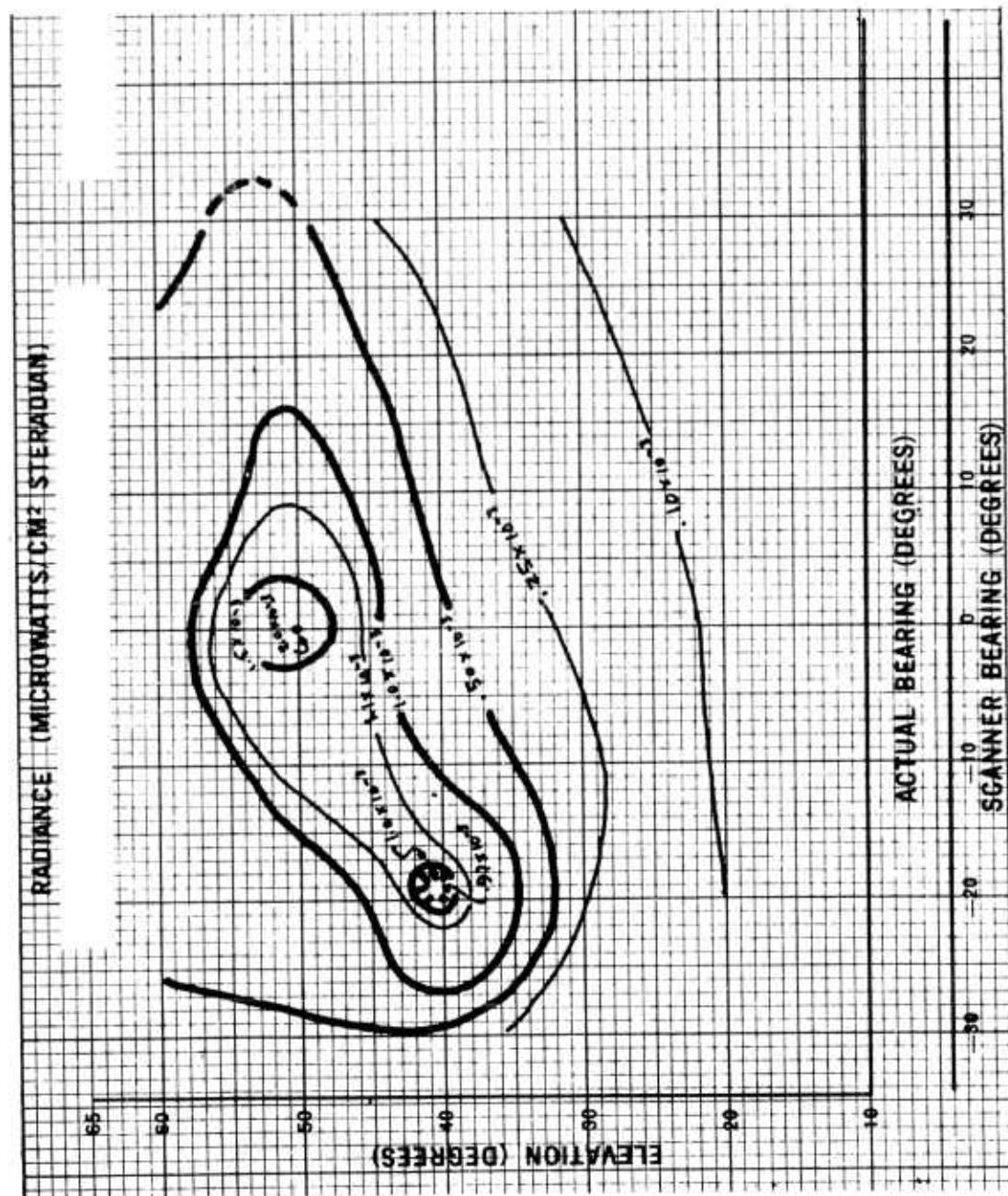
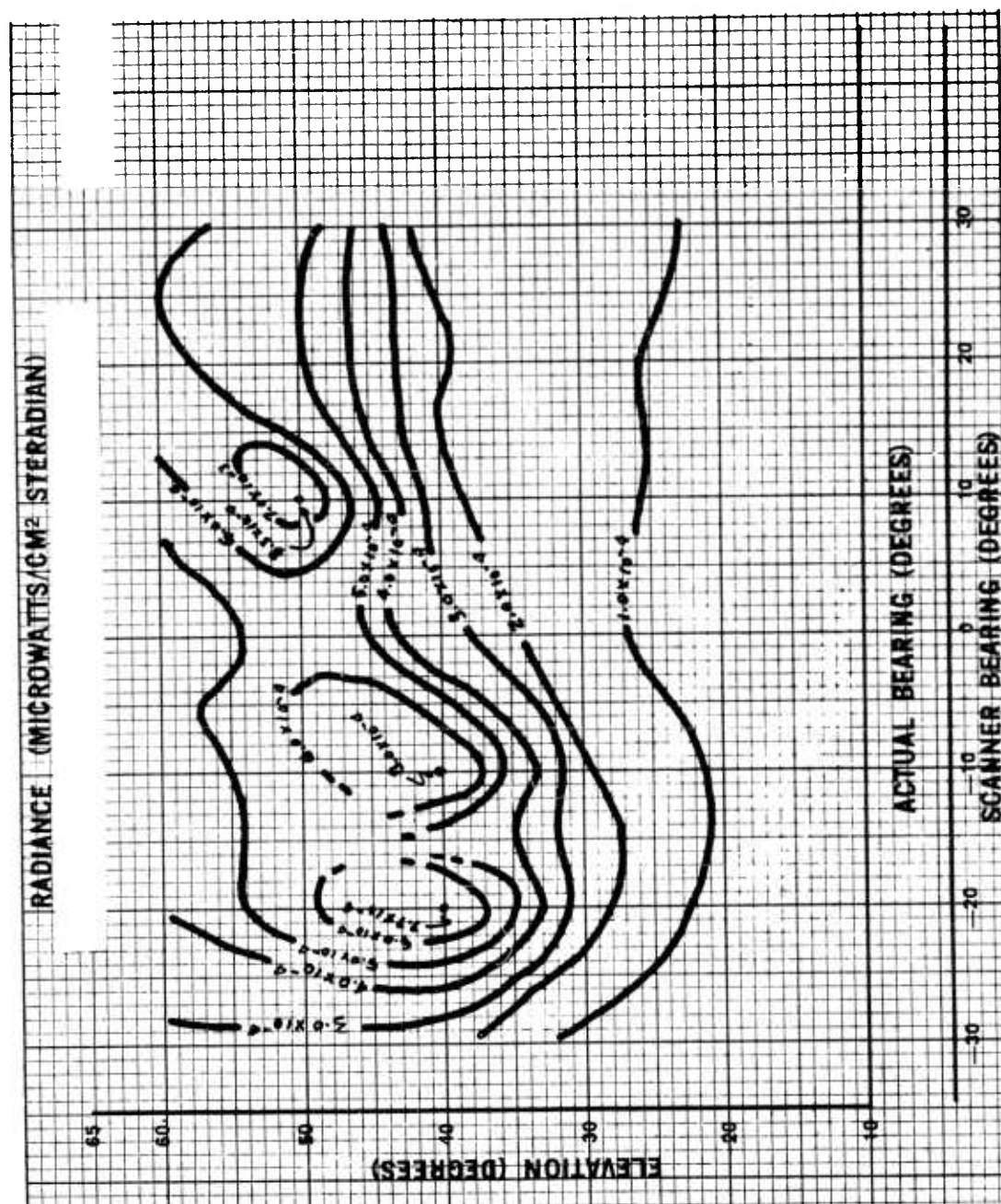


Figure 3.165 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 245 seconds.





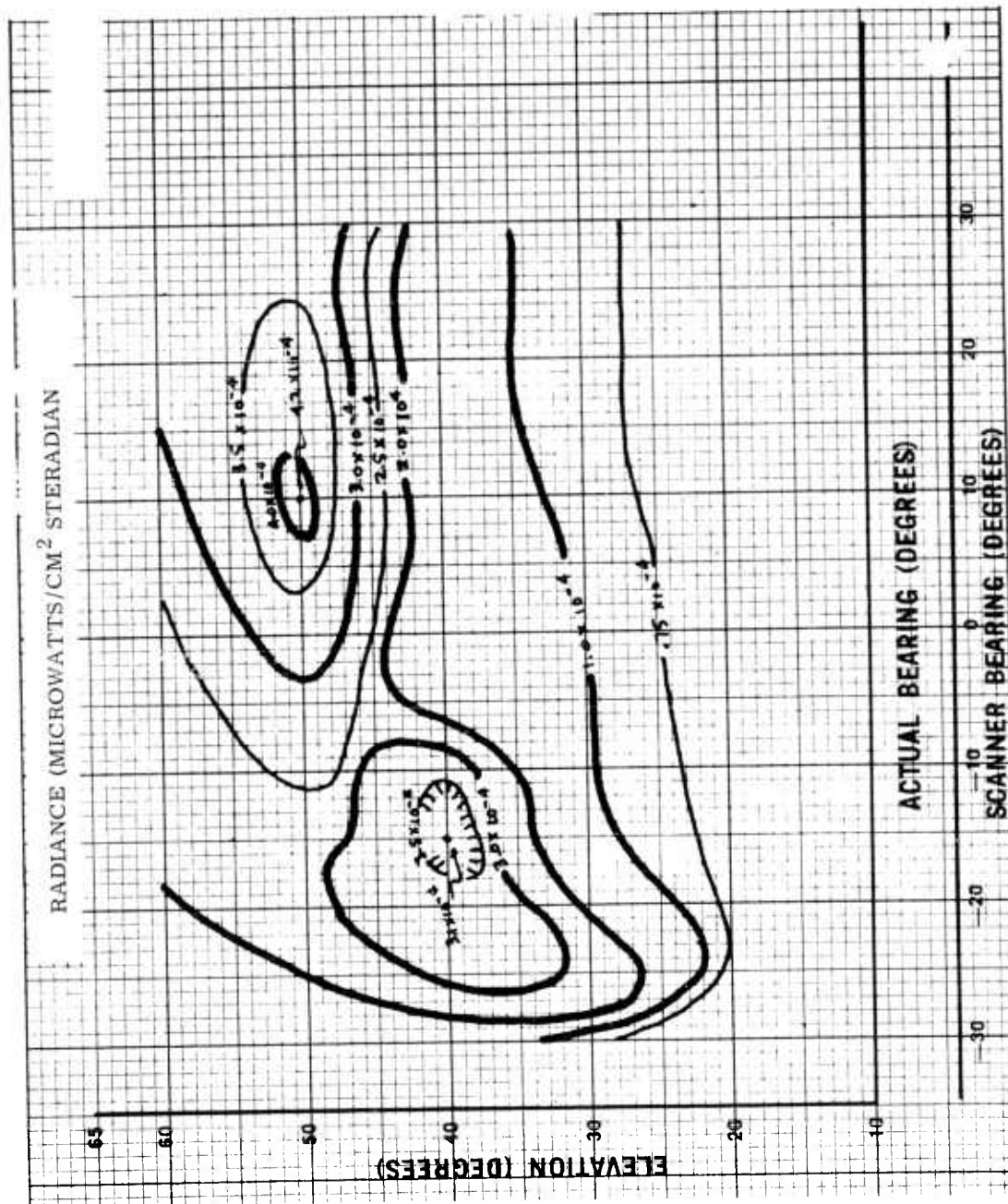


Figure 3.167 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 380 seconds.

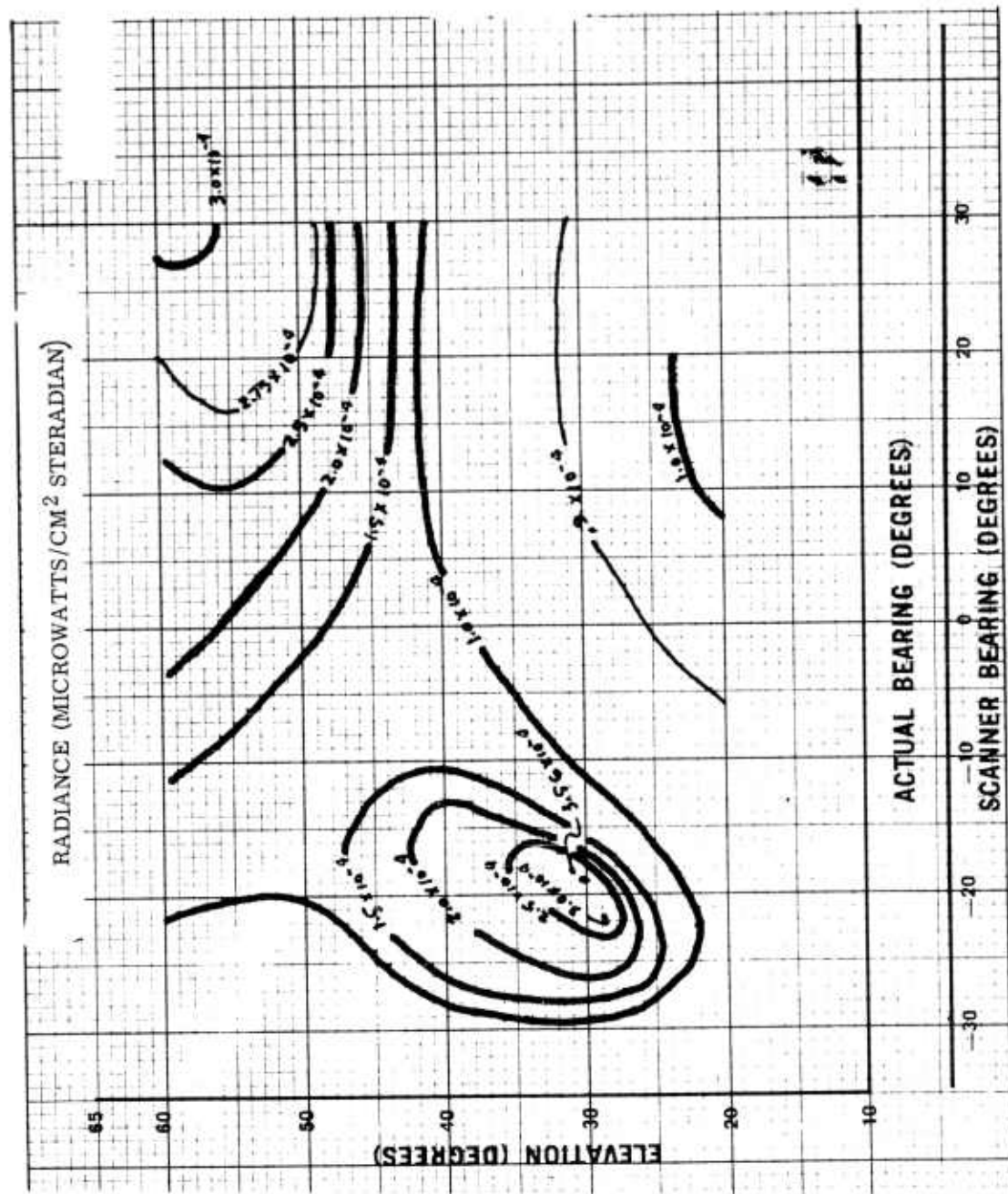


Figure 3.168 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 448 seconds.

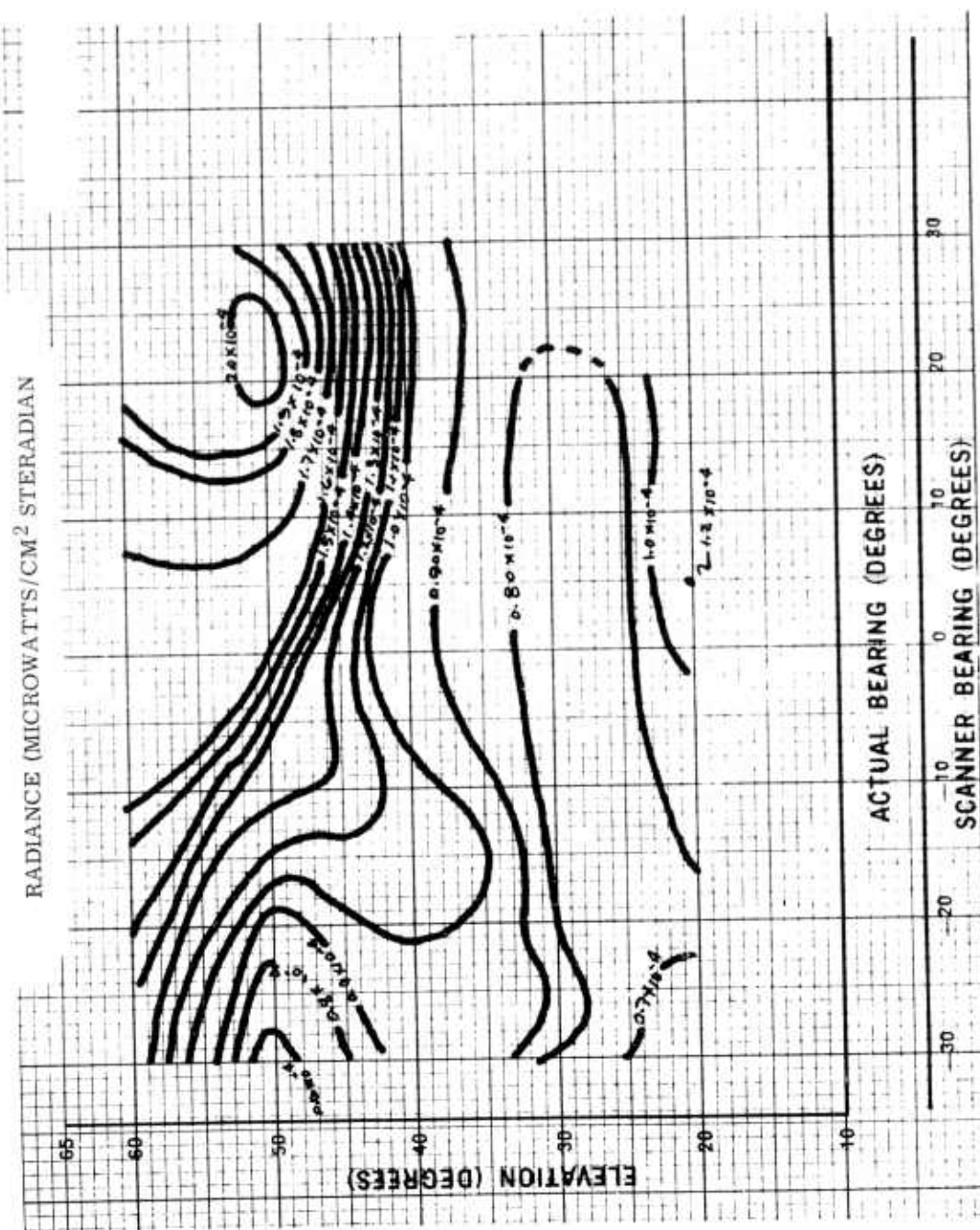
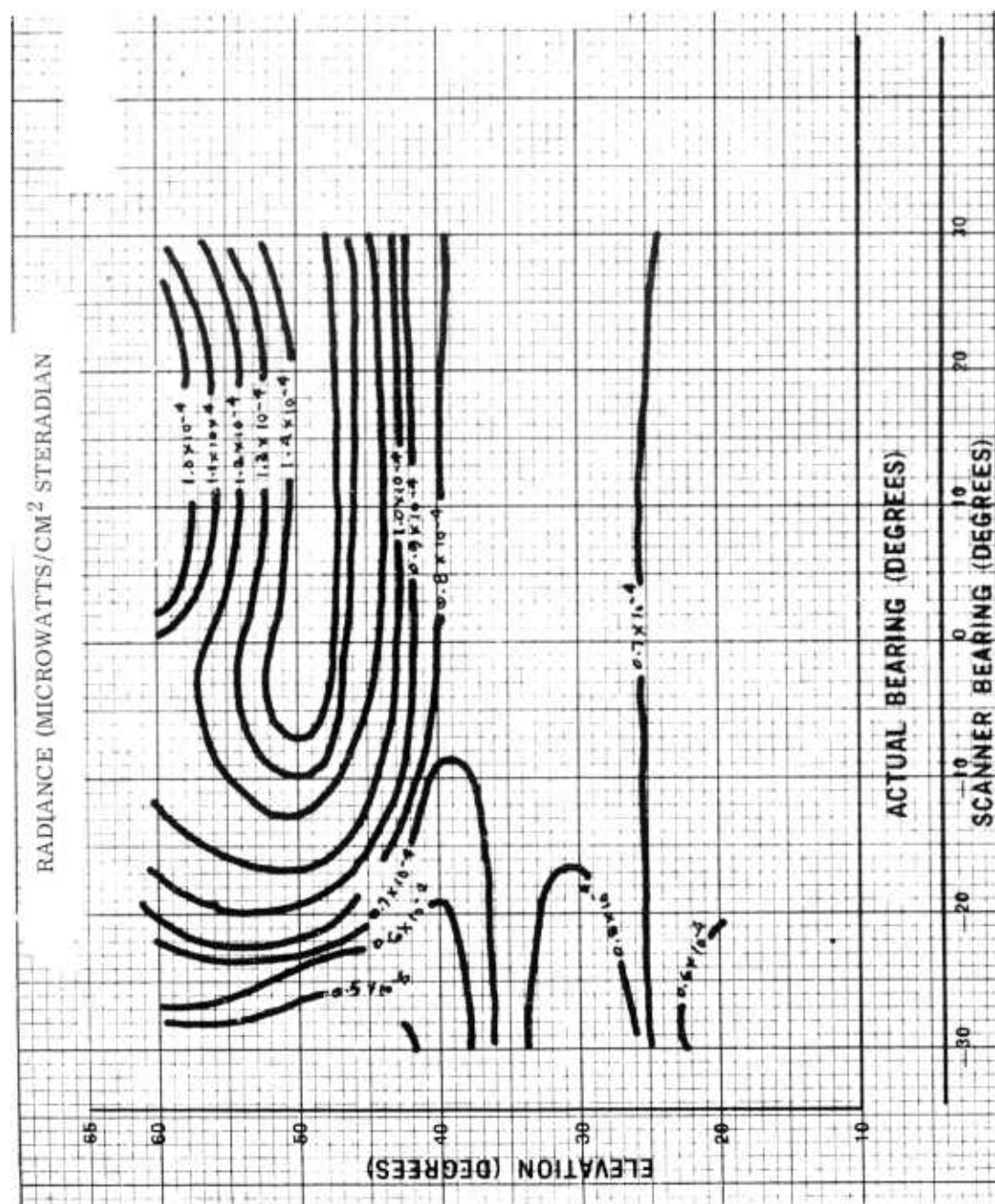


Figure 3.169 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 515 seconds.



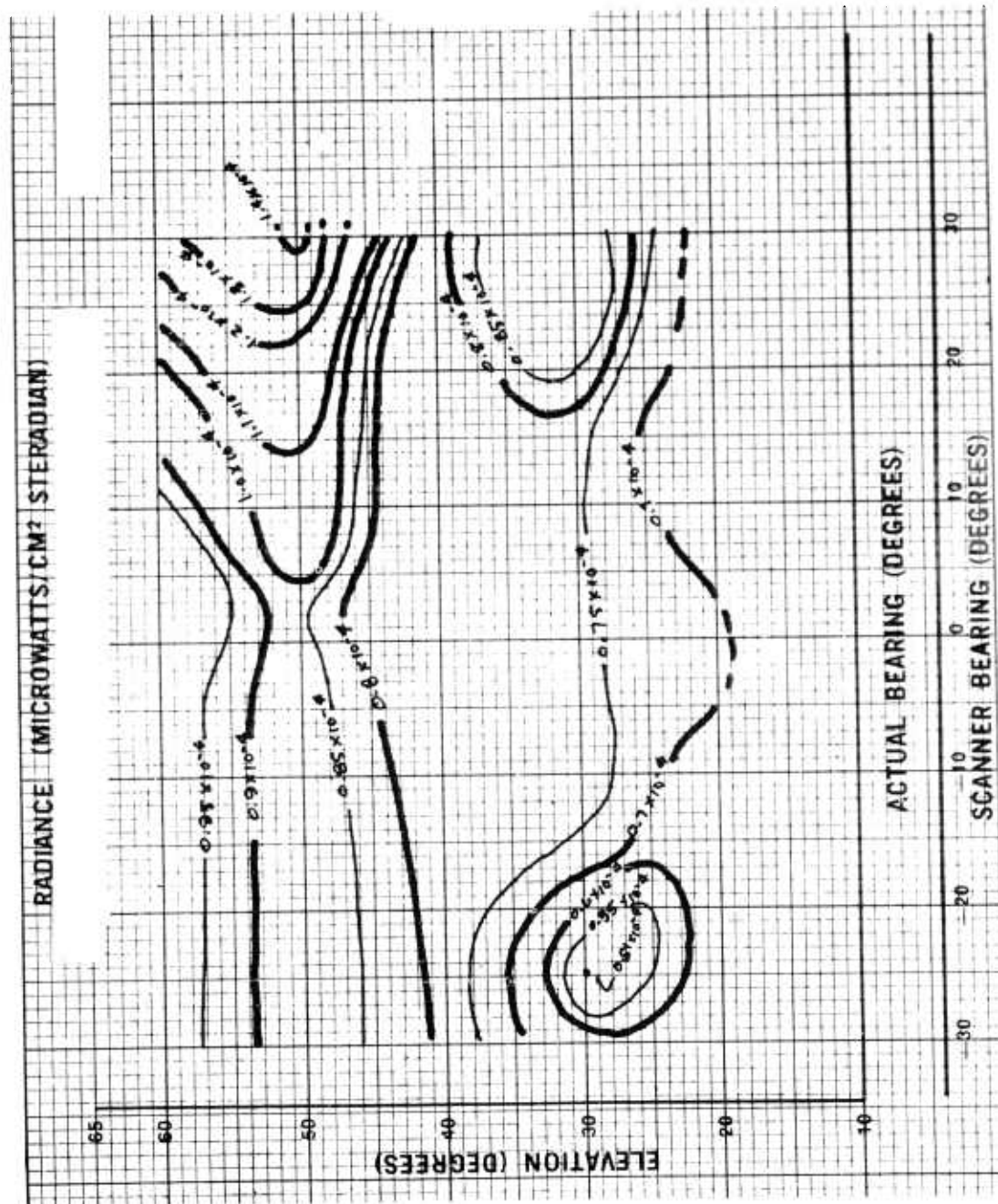


Figure 3.171 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H+651 seconds.



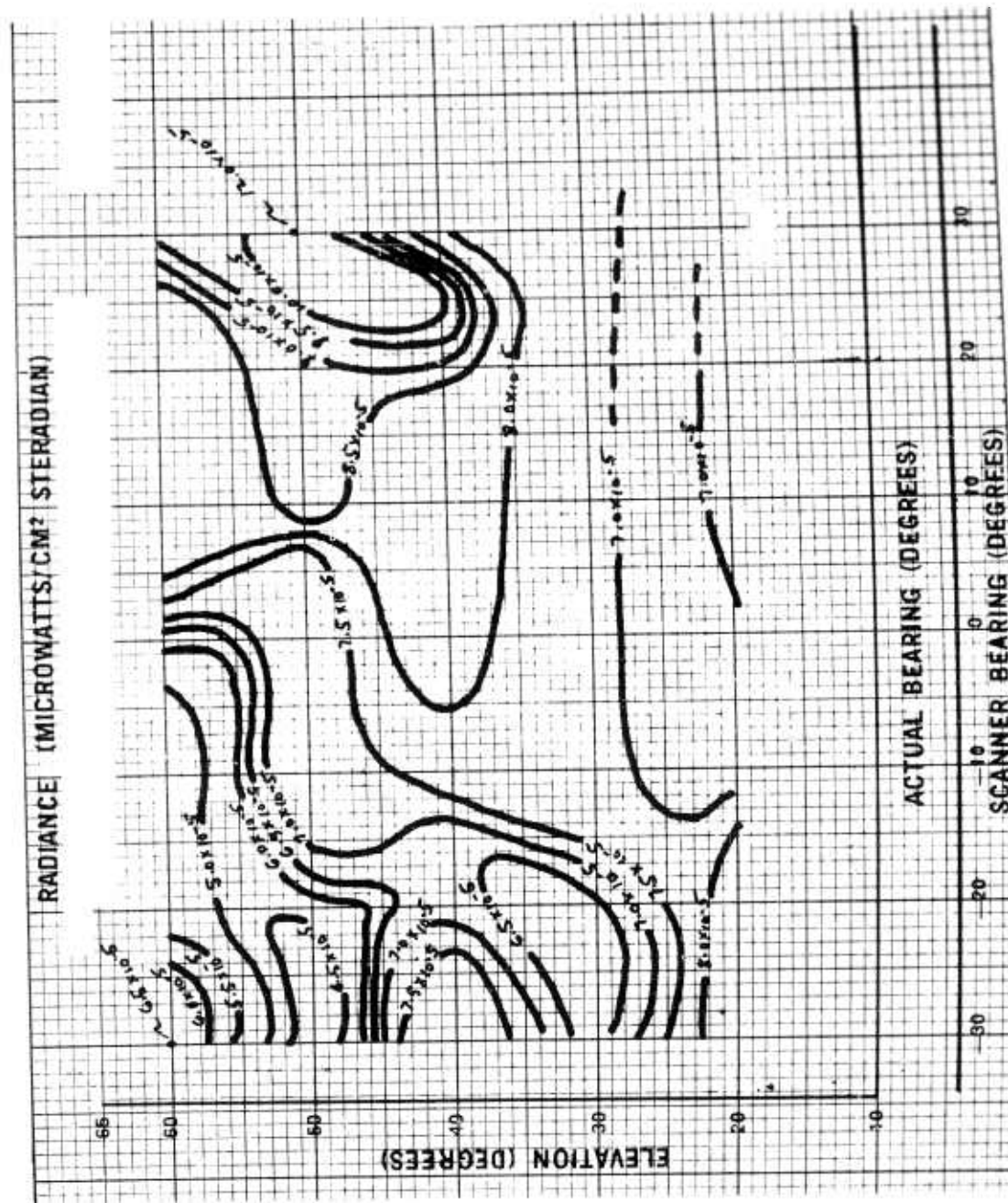
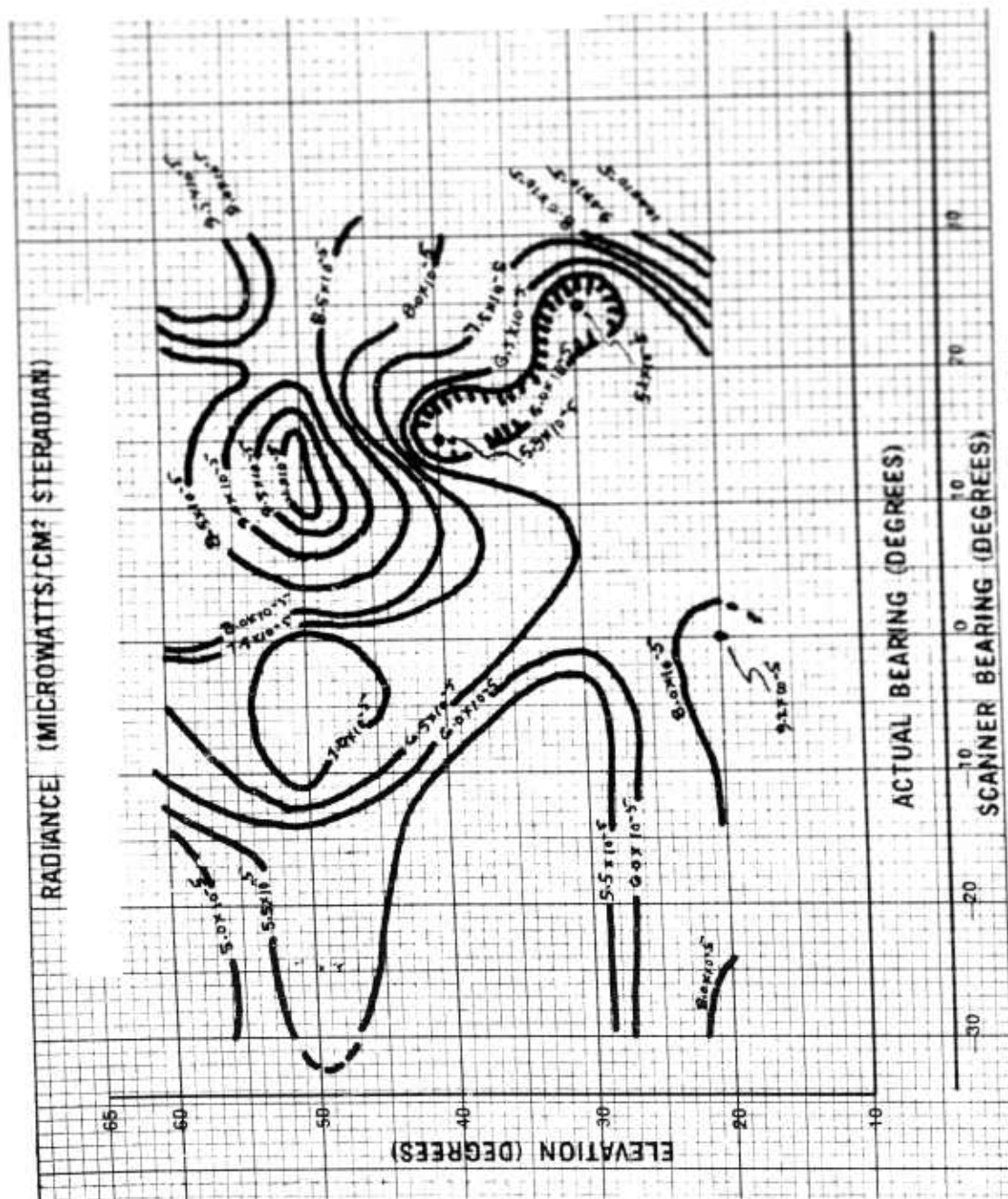


Figure 3.172 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 786 seconds.



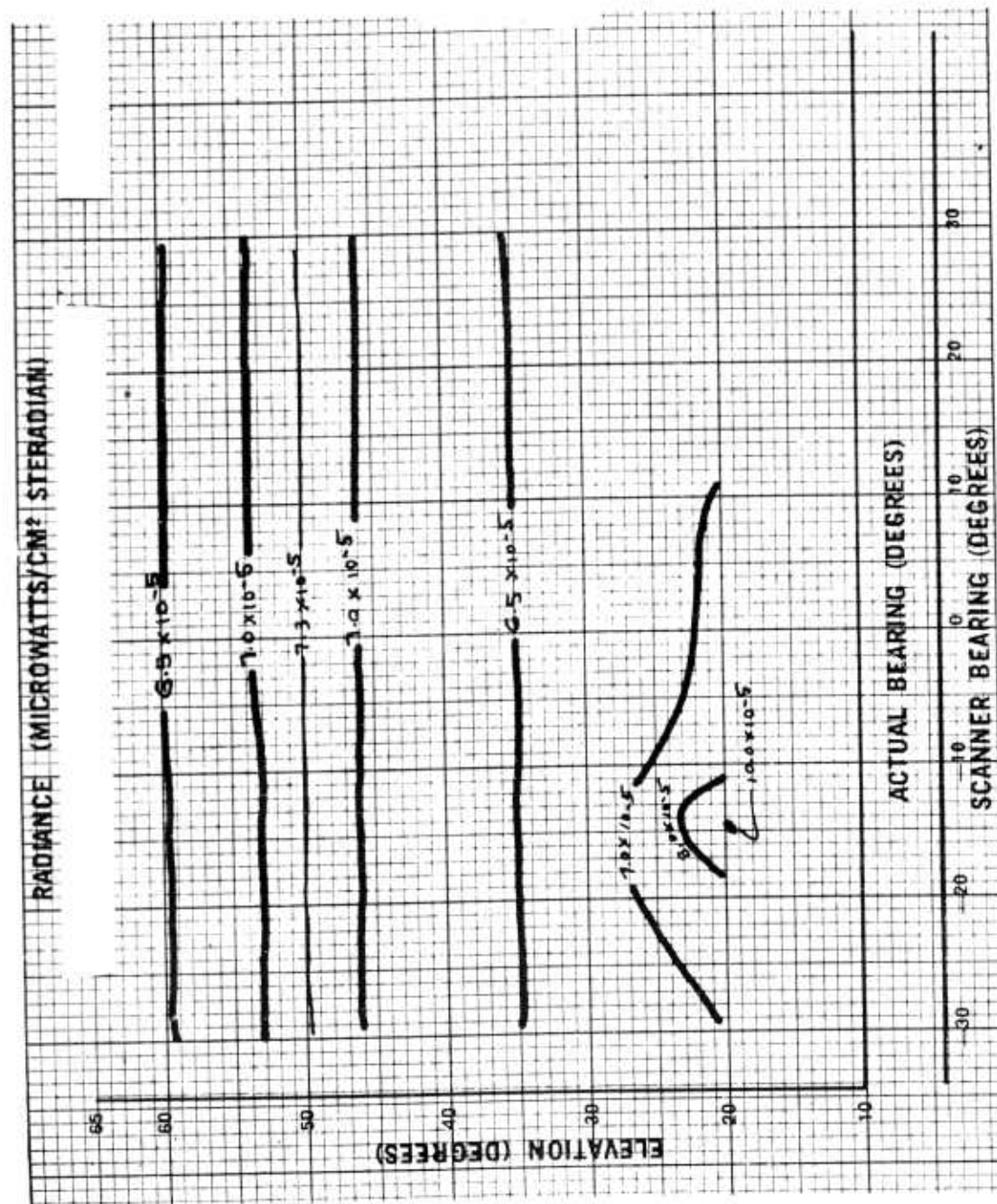


Figure 3.174 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 921 seconds.



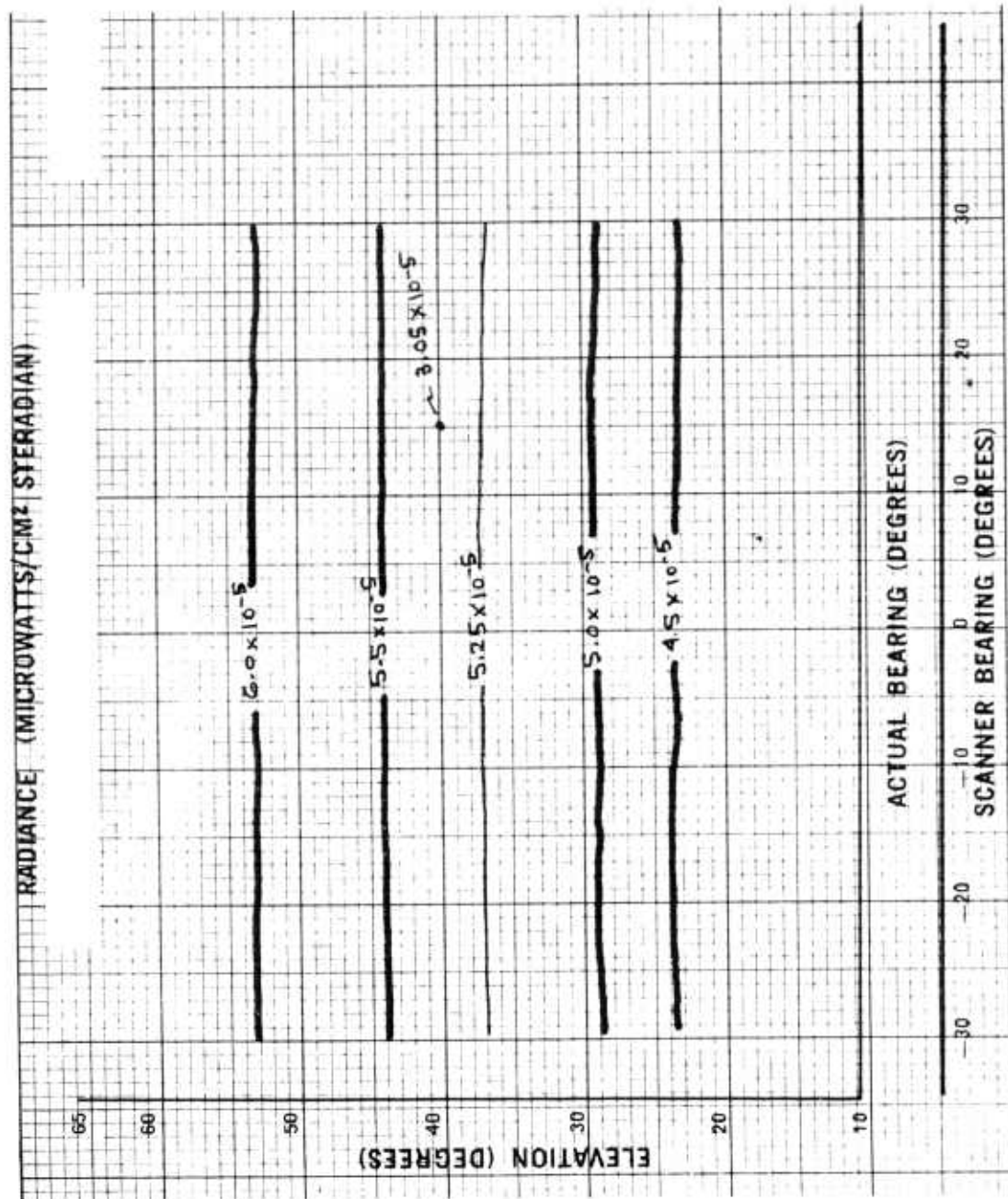


Figure 3.175 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 1.937 seconds.

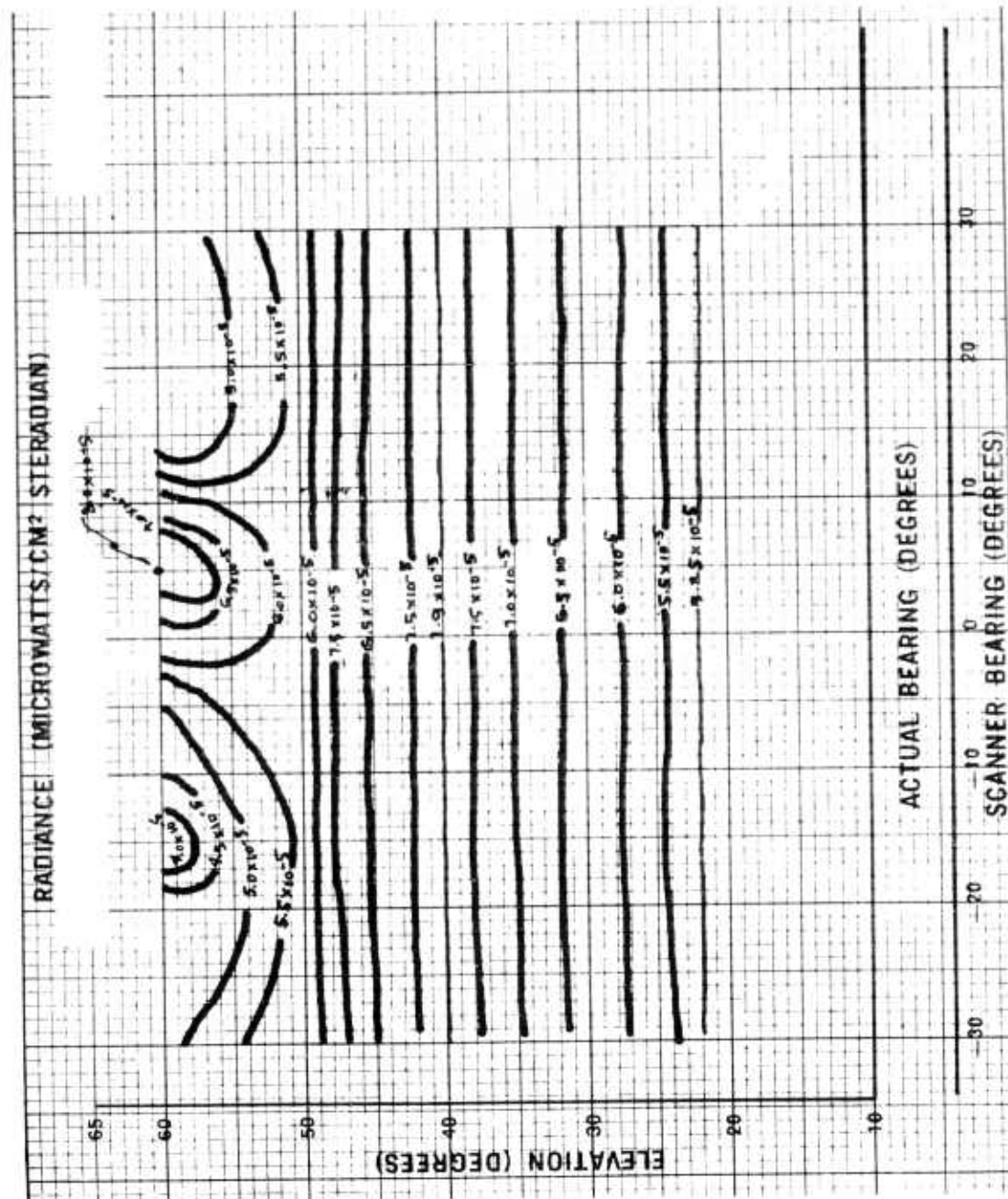


Figure 3.176 Sky radiance, Kettle I, Check Mate, 0.373 to 0.396 microns, H + 2,208 seconds.

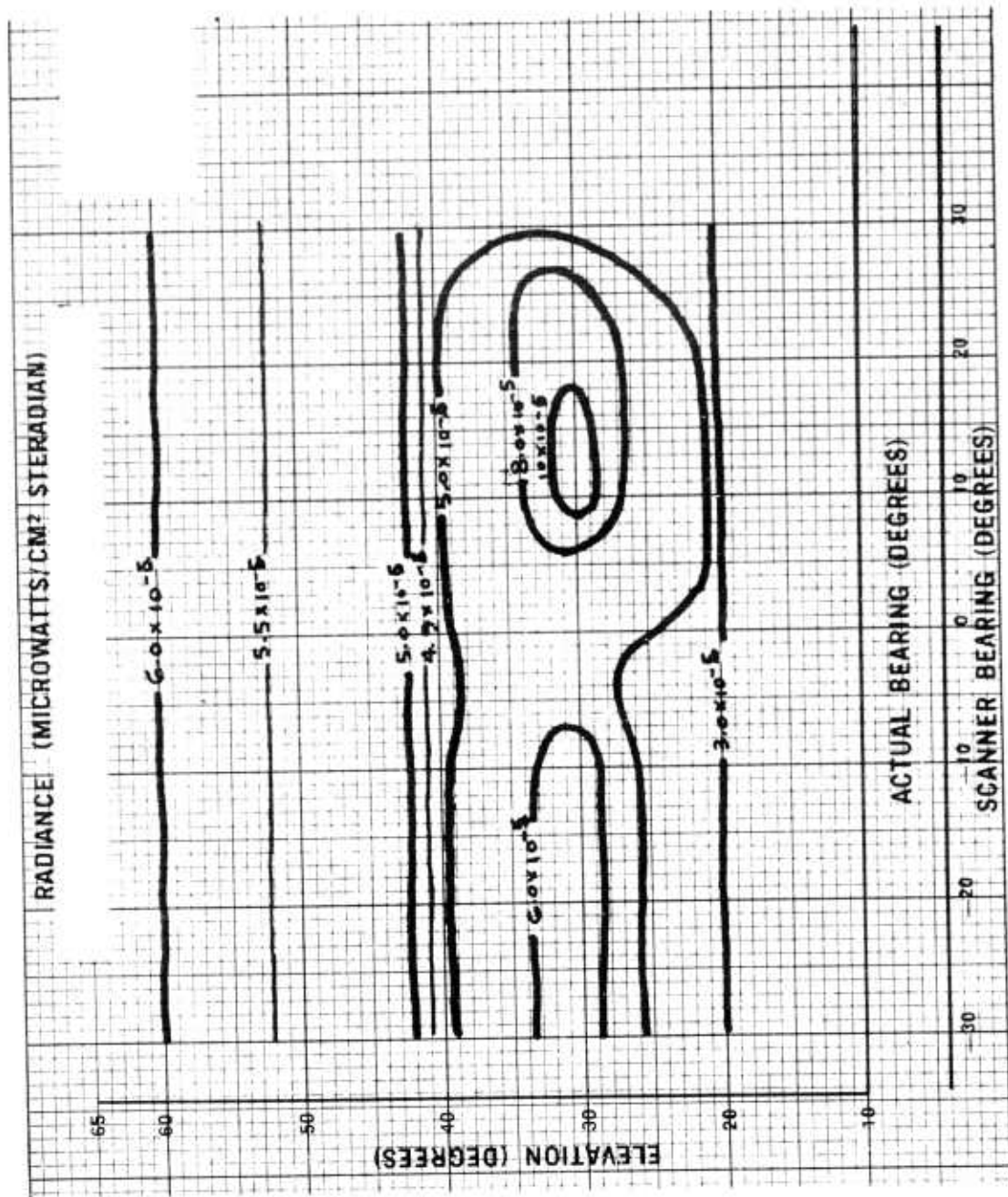


Figure 3.177 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H-286 seconds.



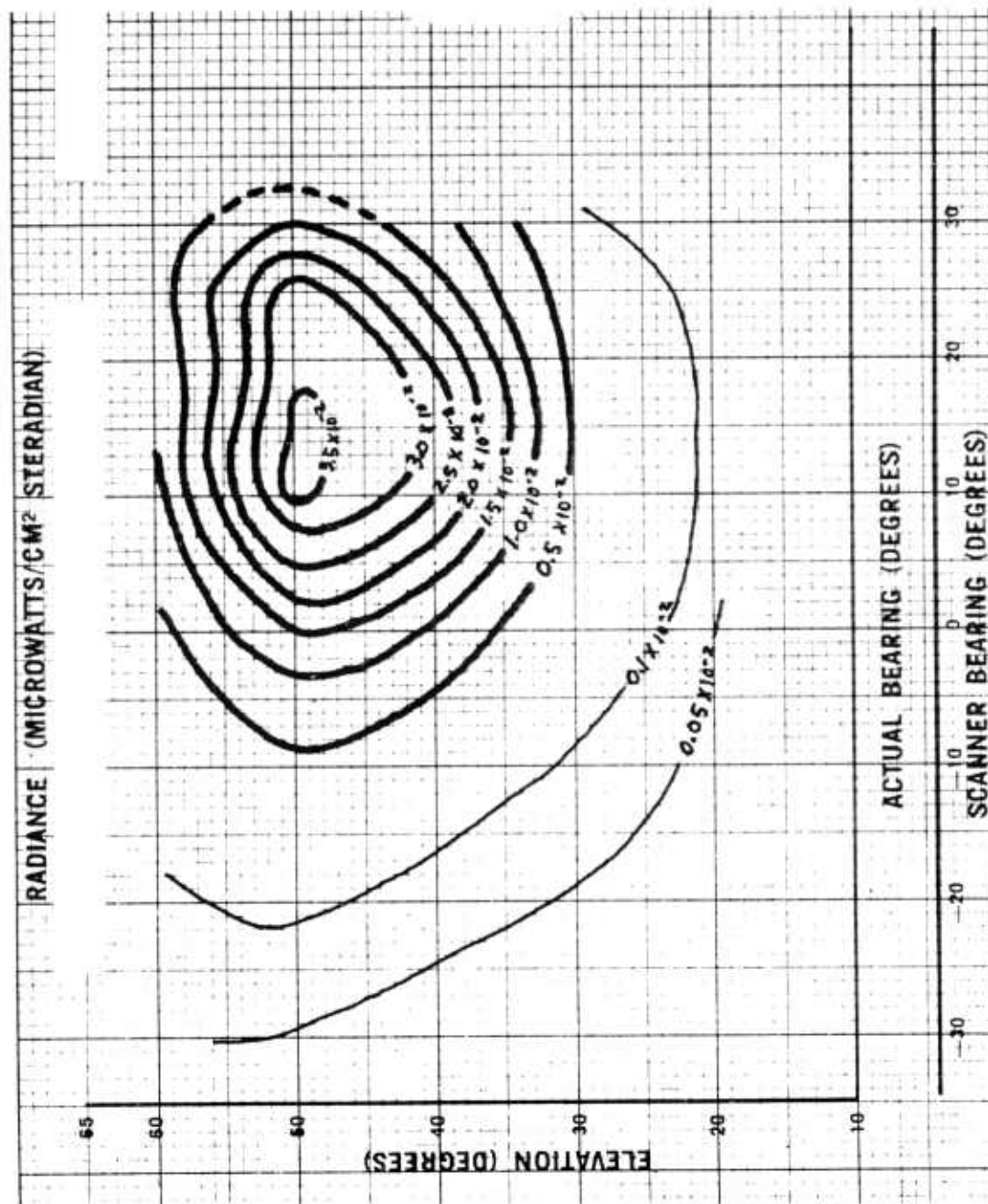


Figure 3.179 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 120 seconds.



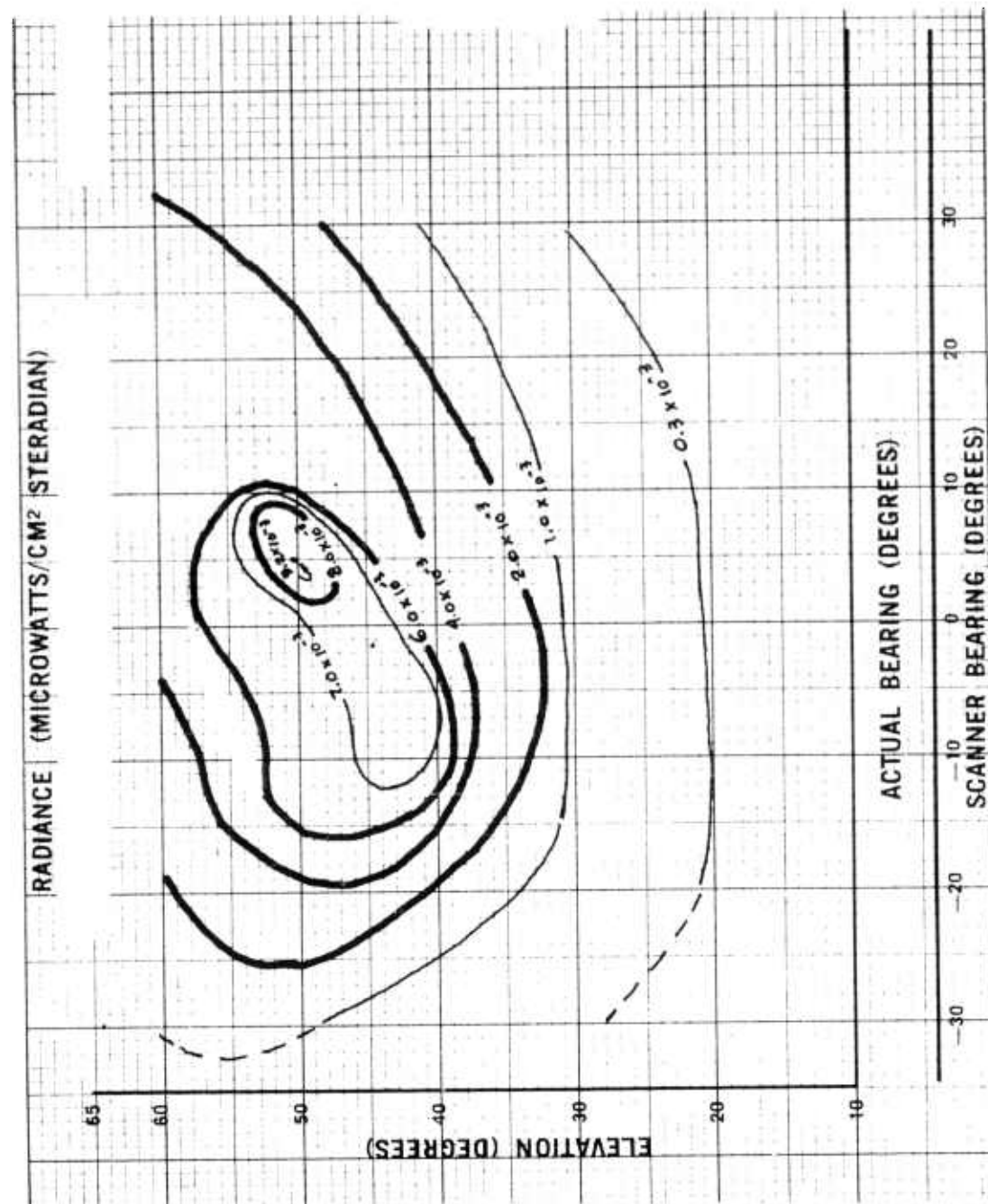


Figure 3.180 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 188 seconds.

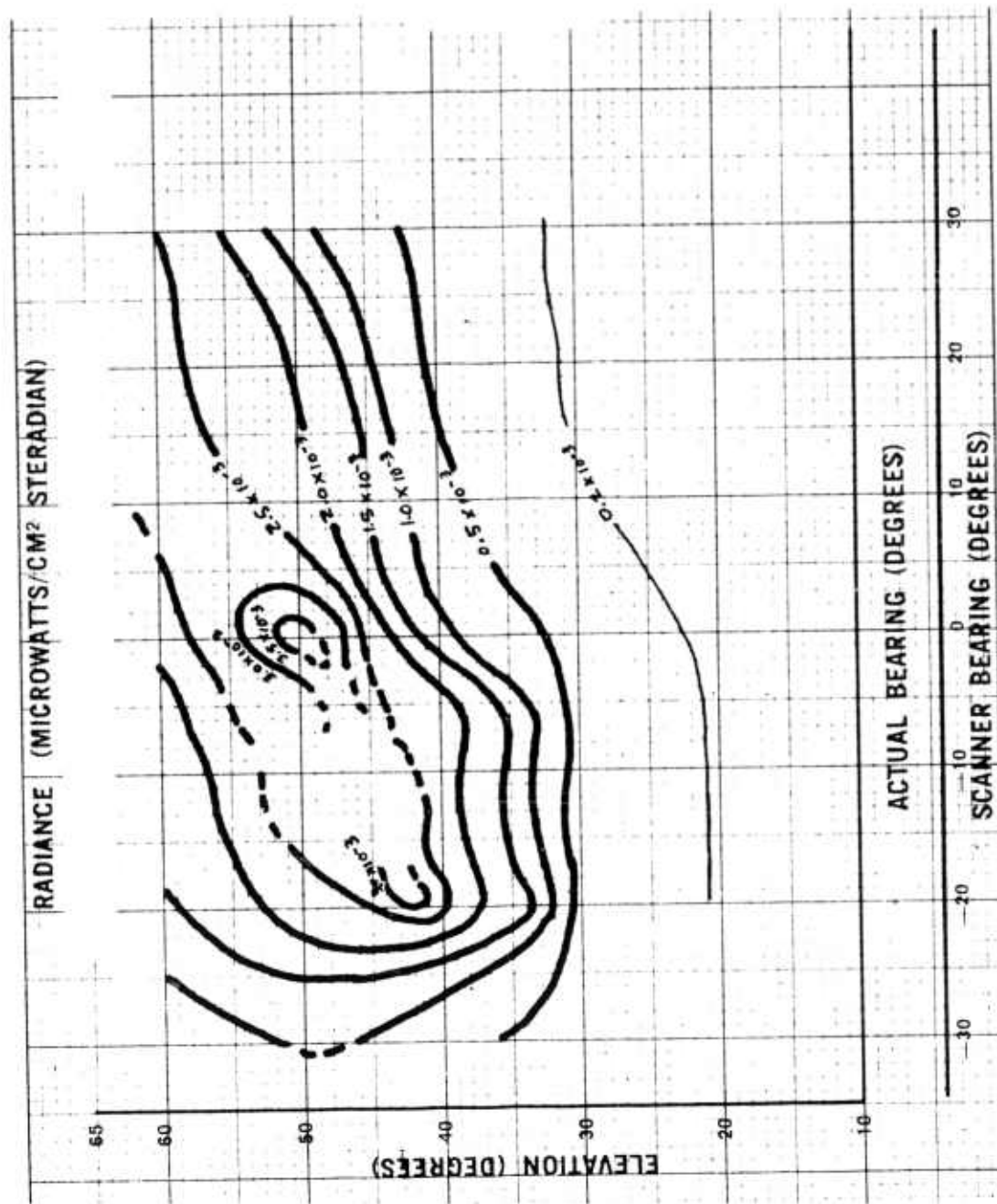
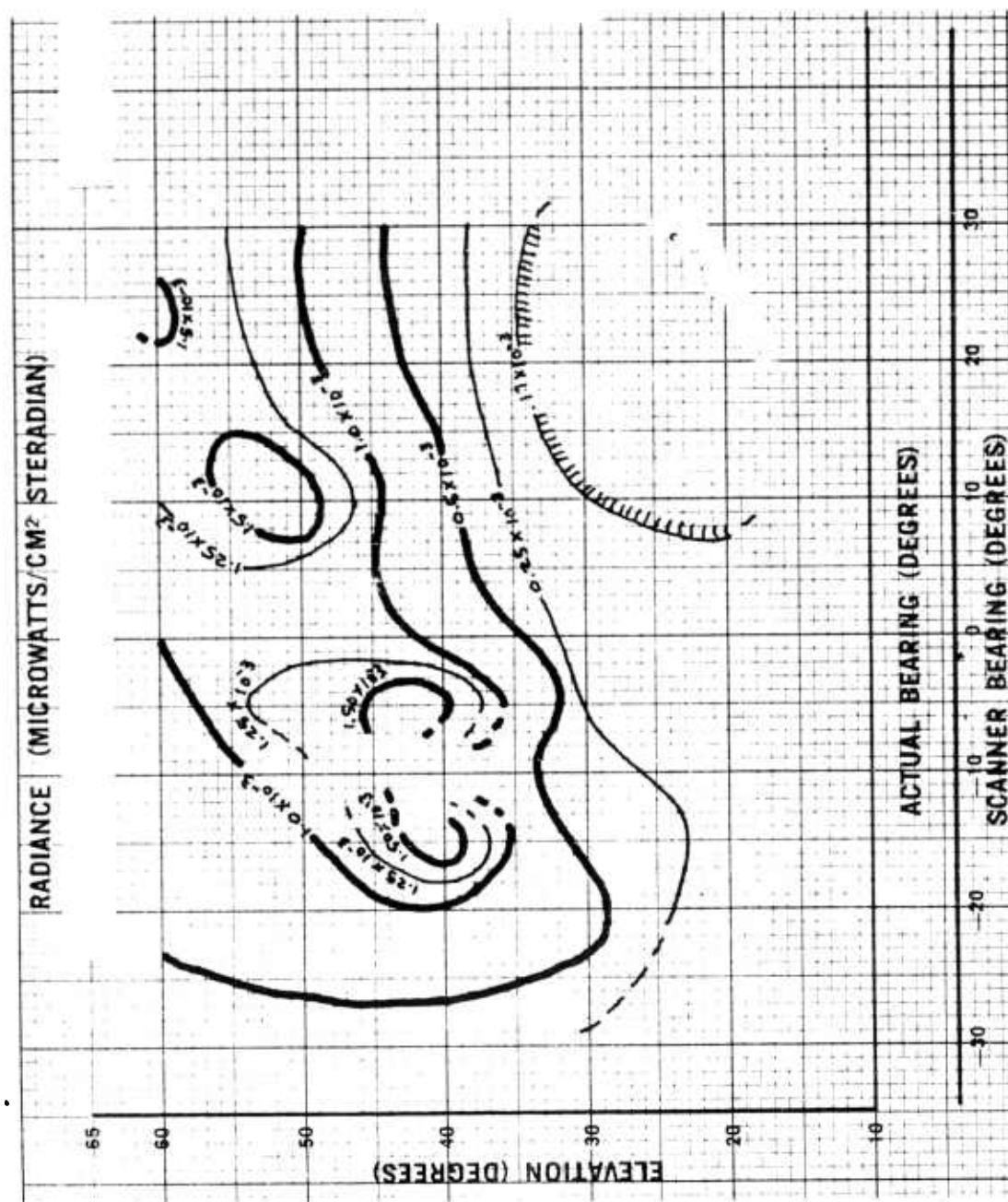


Figure 3.181 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 256 seconds.





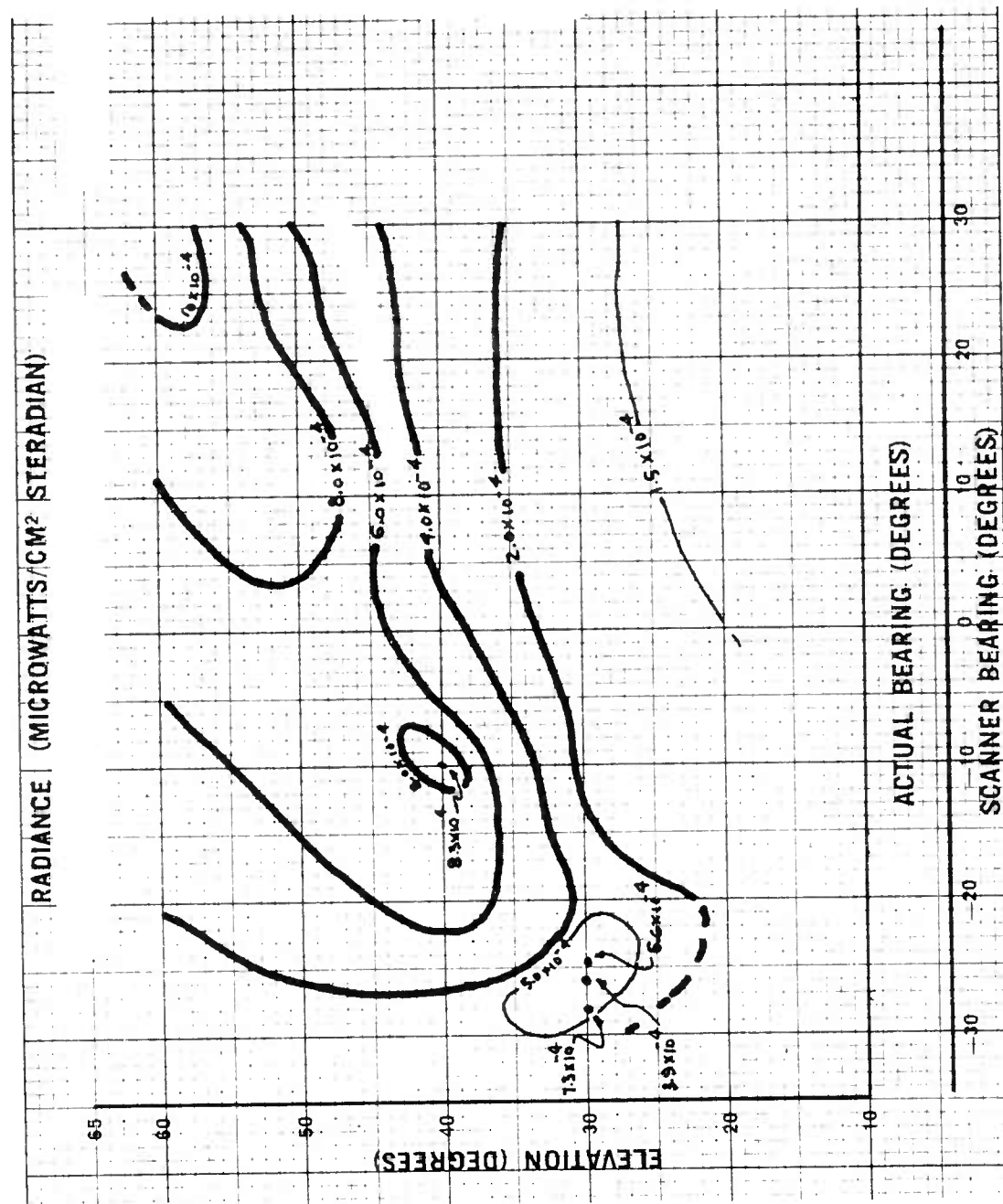
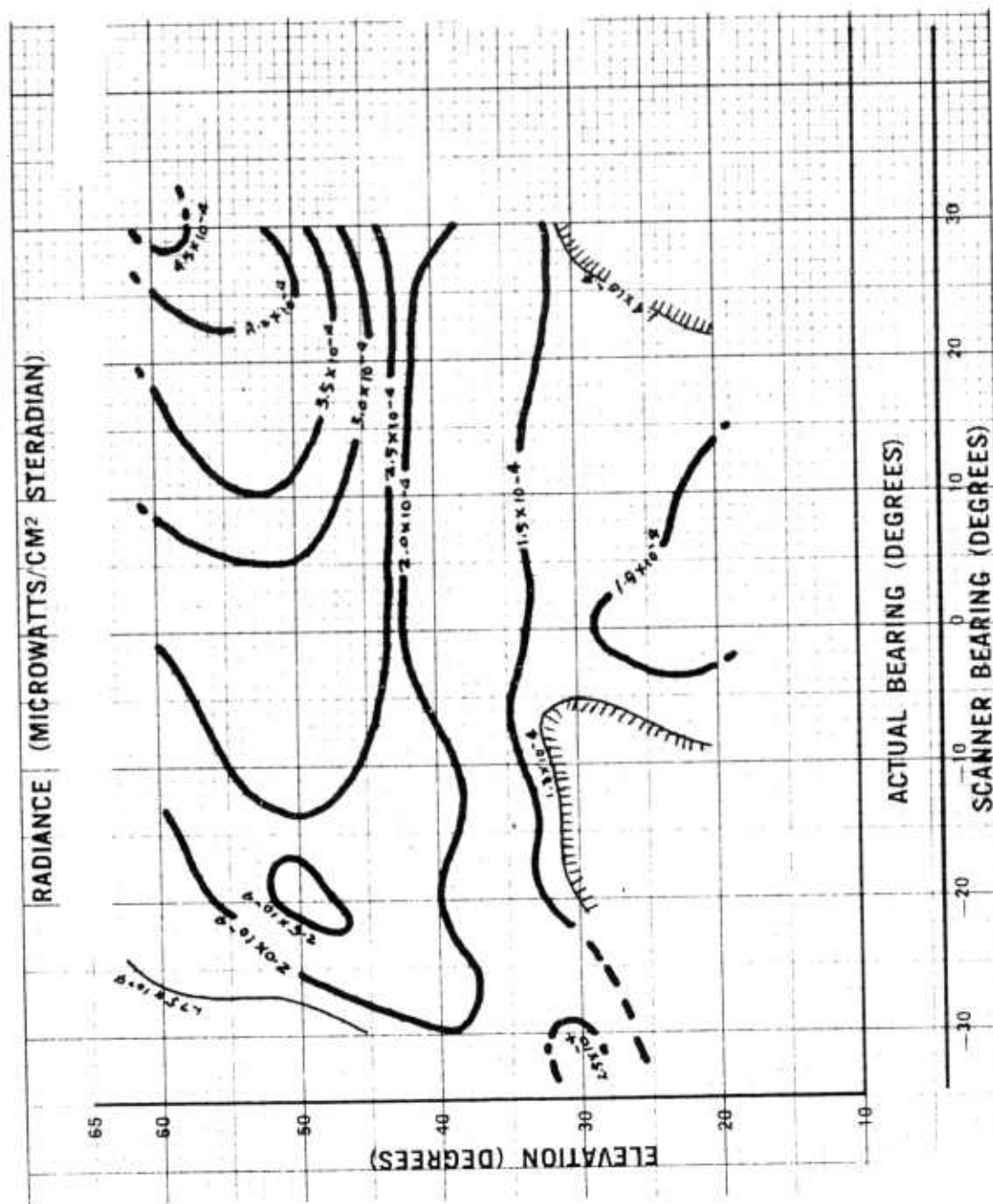


Figure 3.183 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 391 seconds.





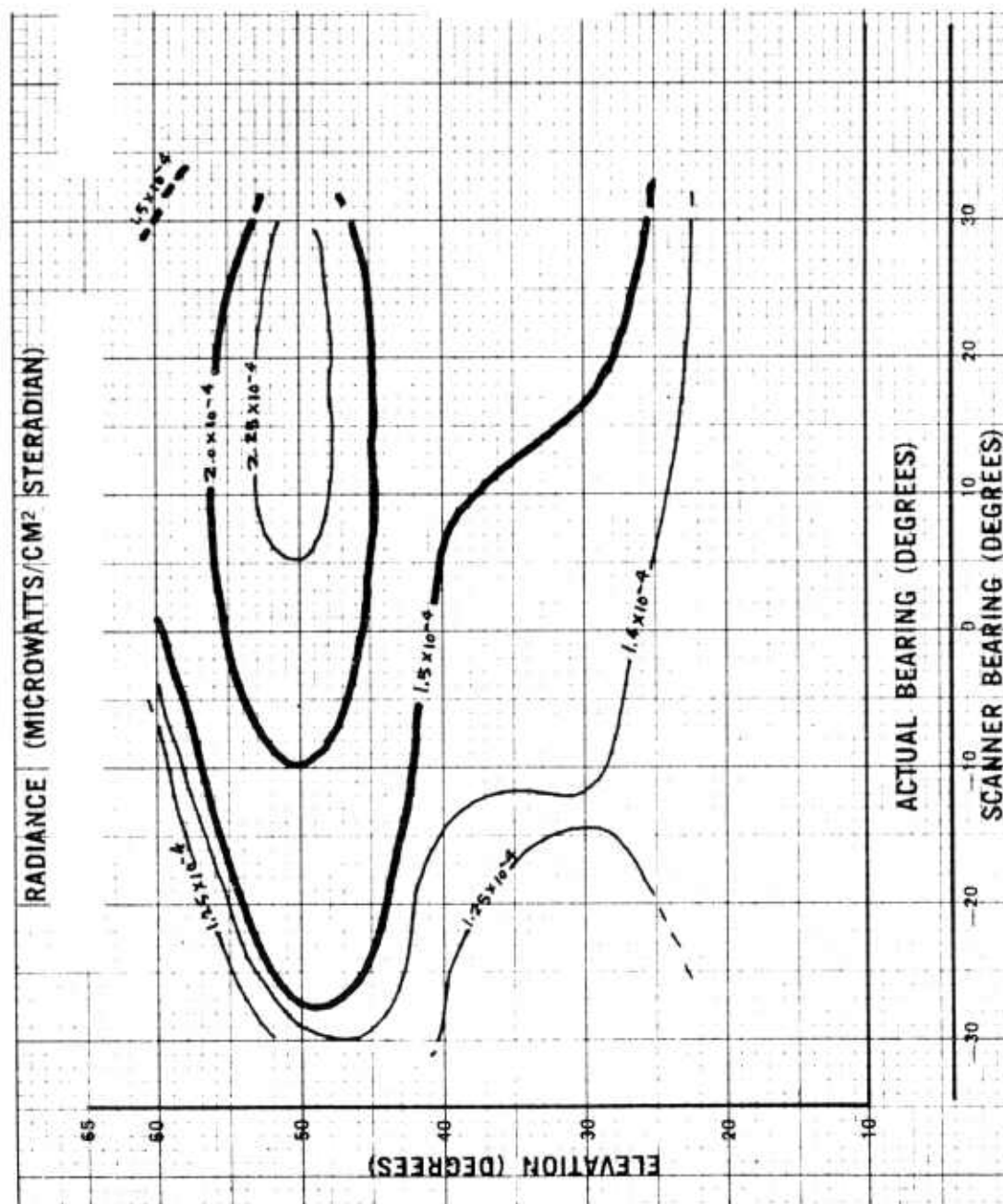


Figure 3.186 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 594 seconds.

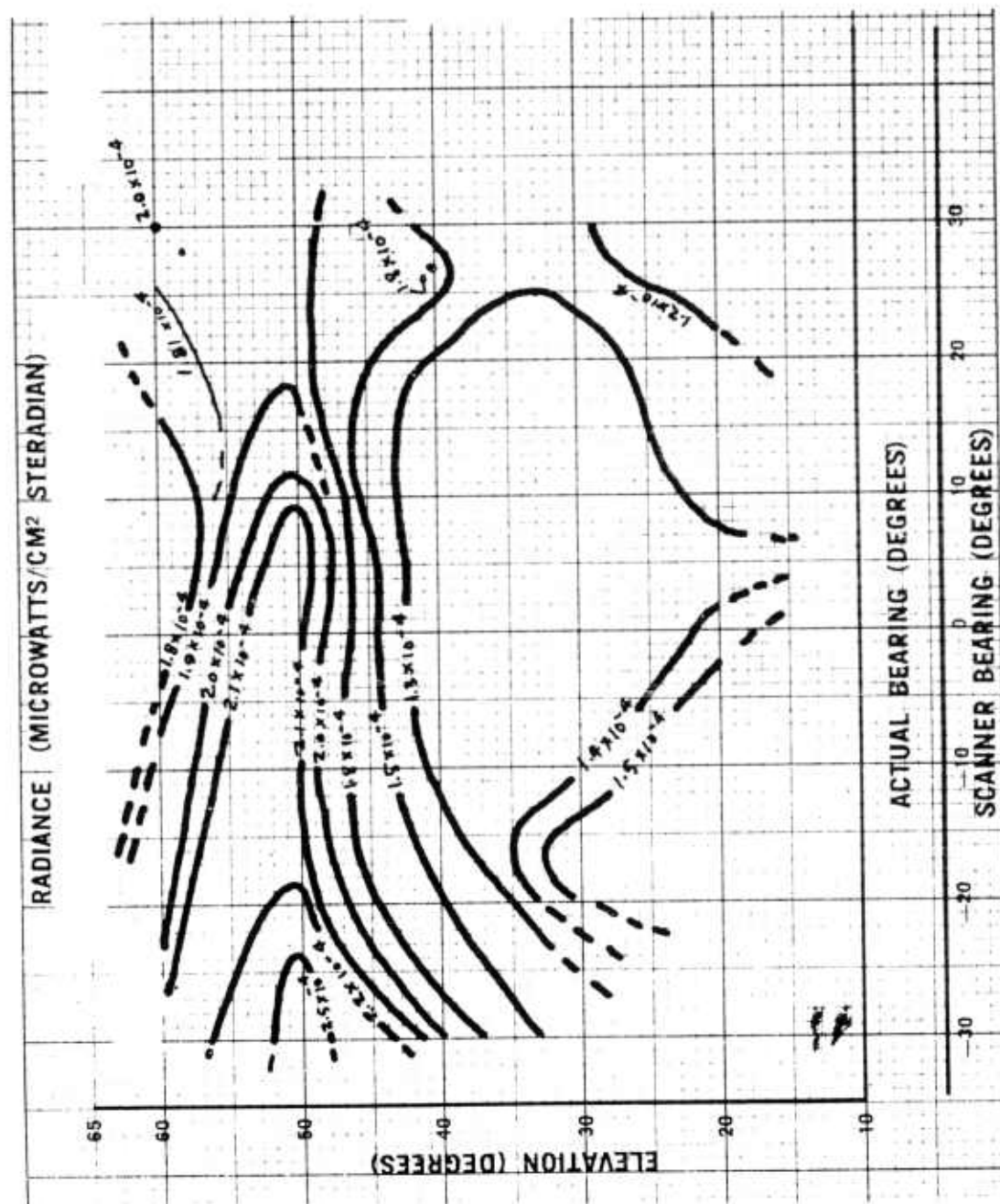
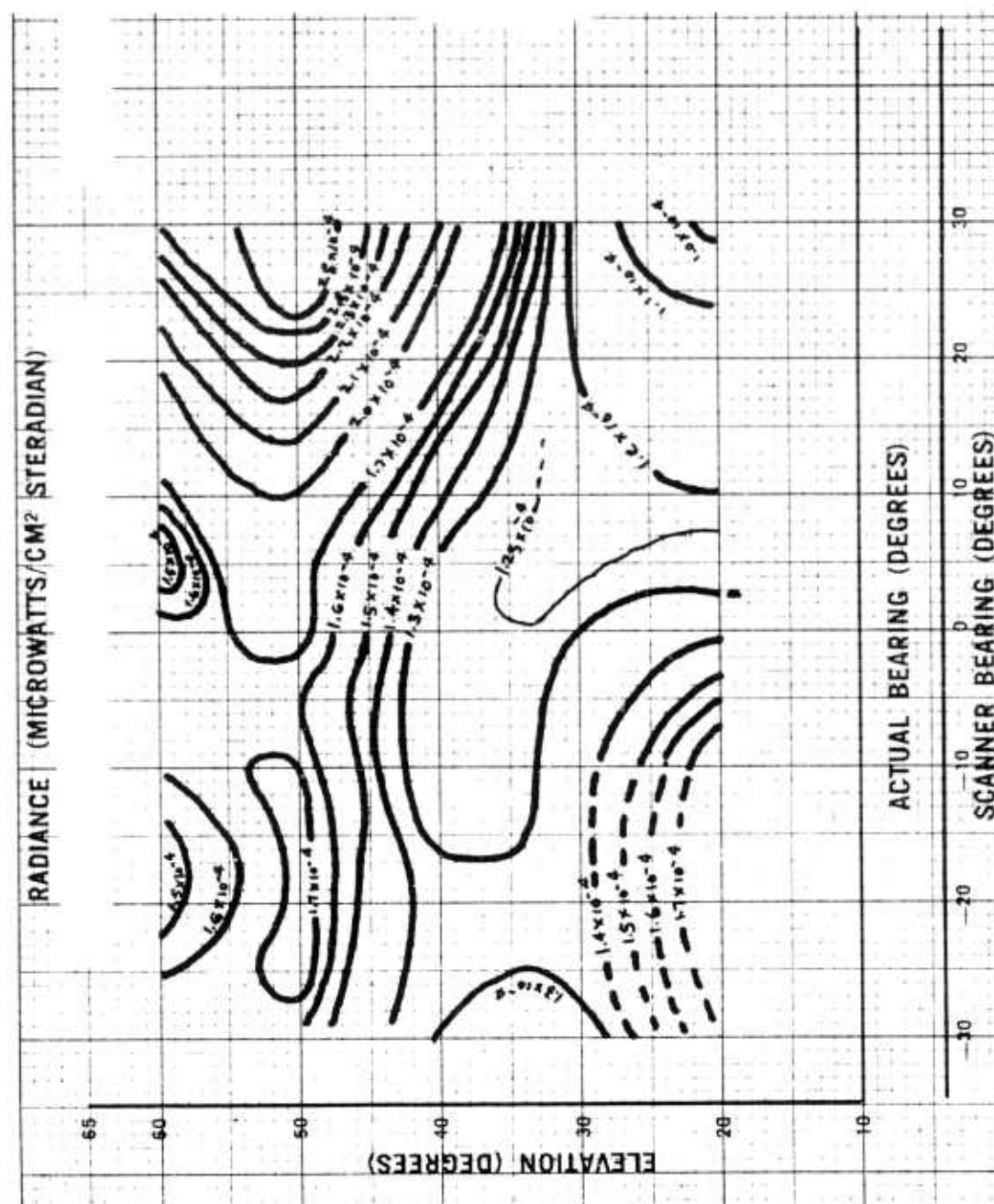
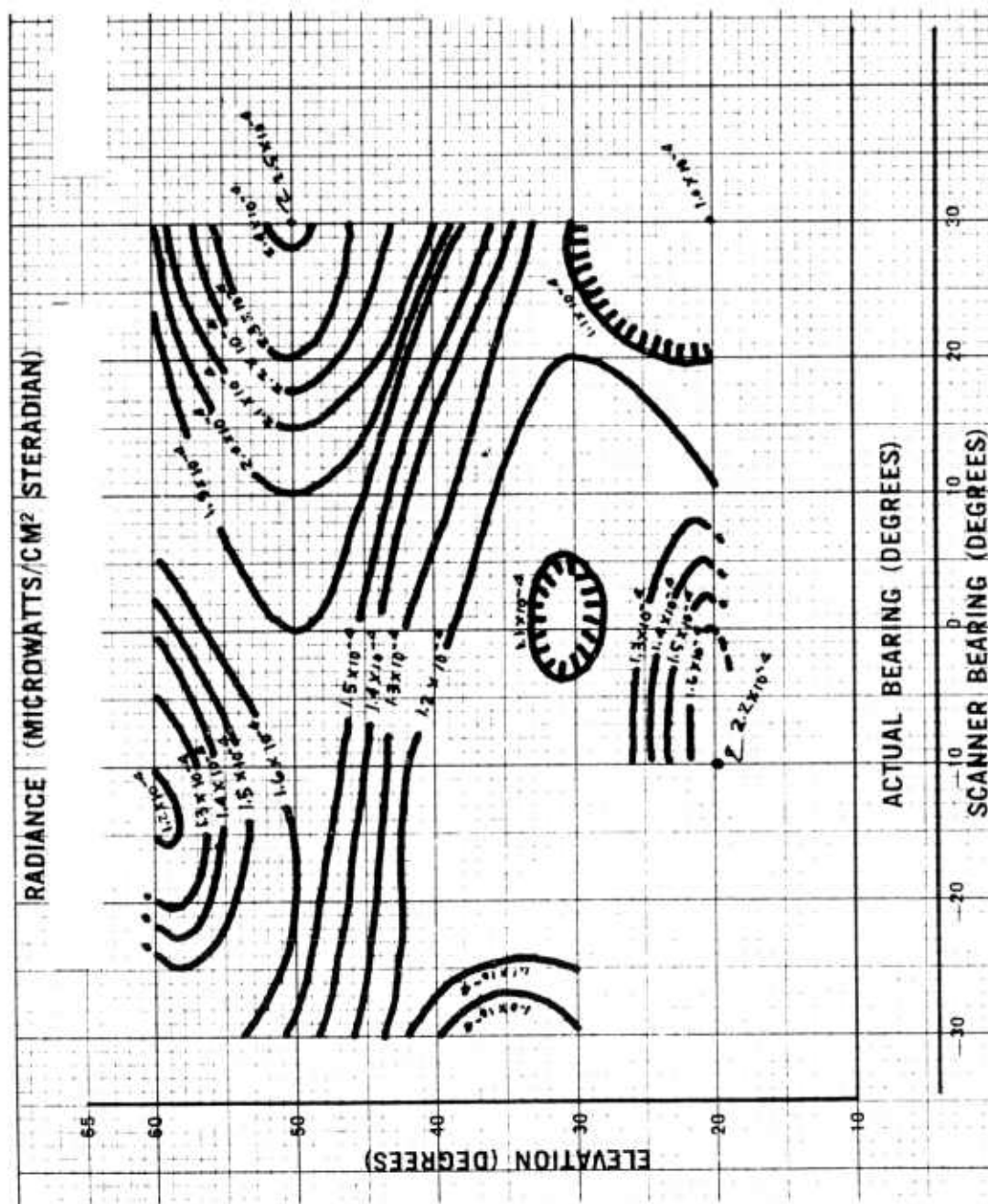


Figure 3.187 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 662 seconds.

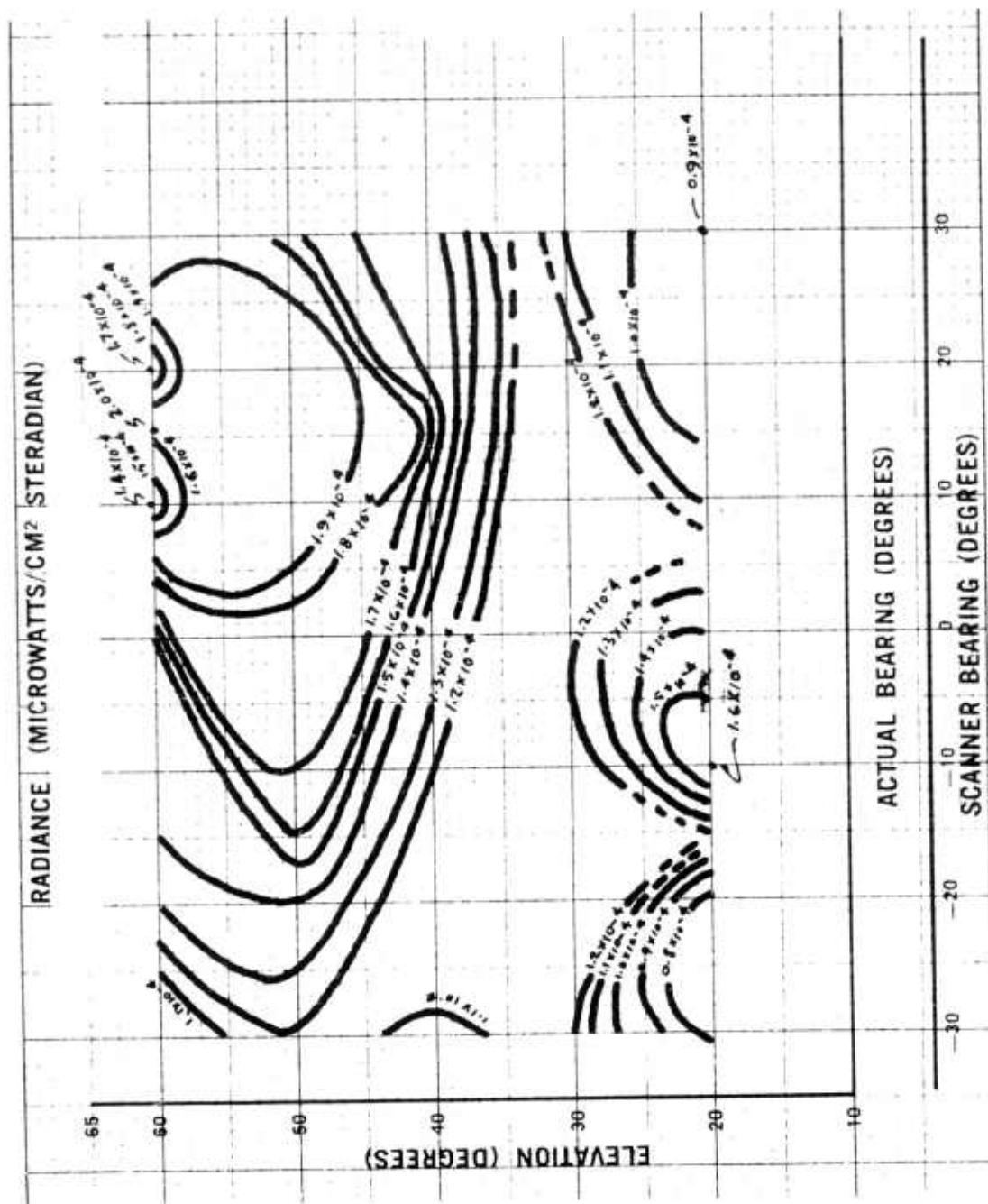












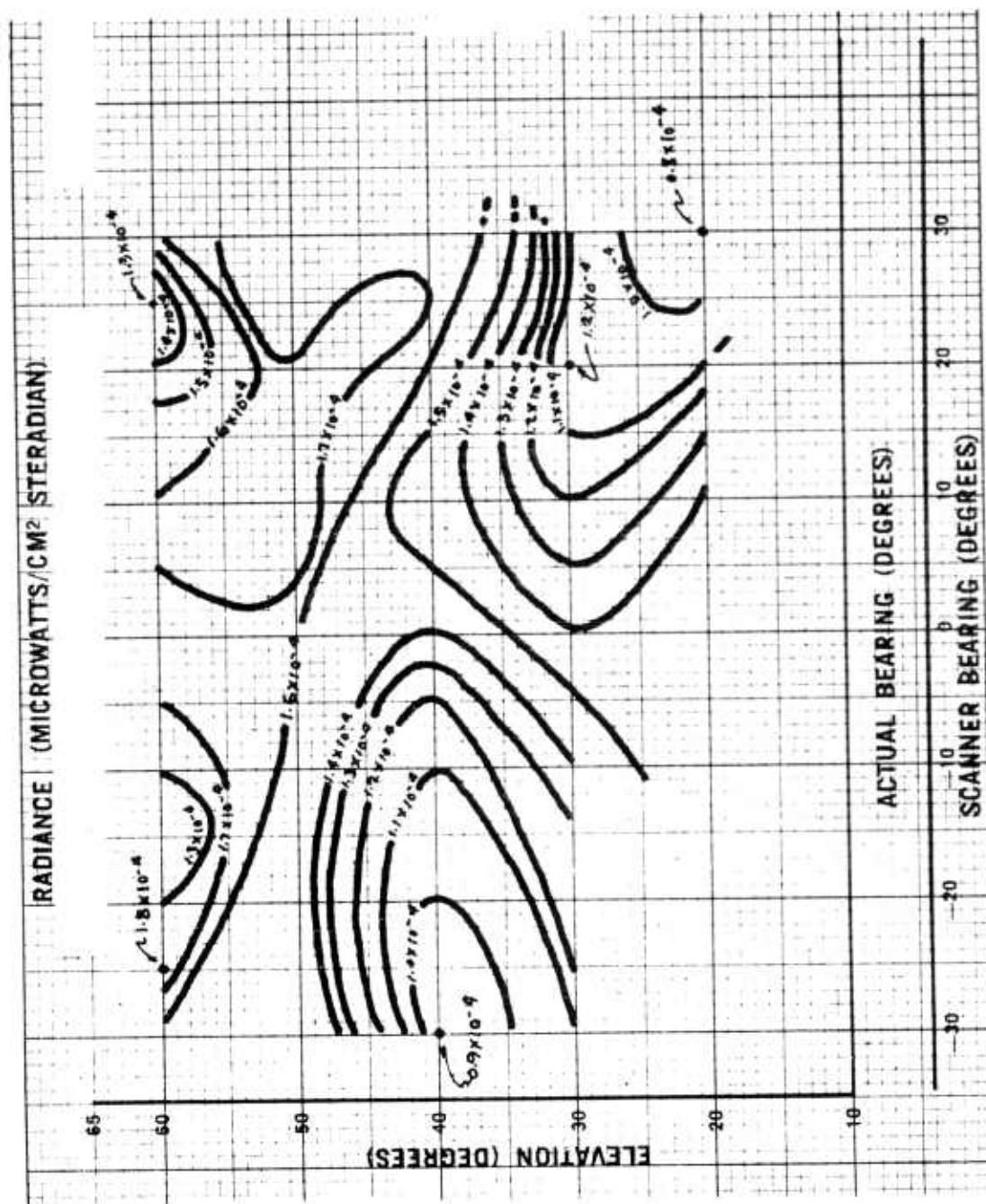


Figure 3.192 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 1,000 seconds.

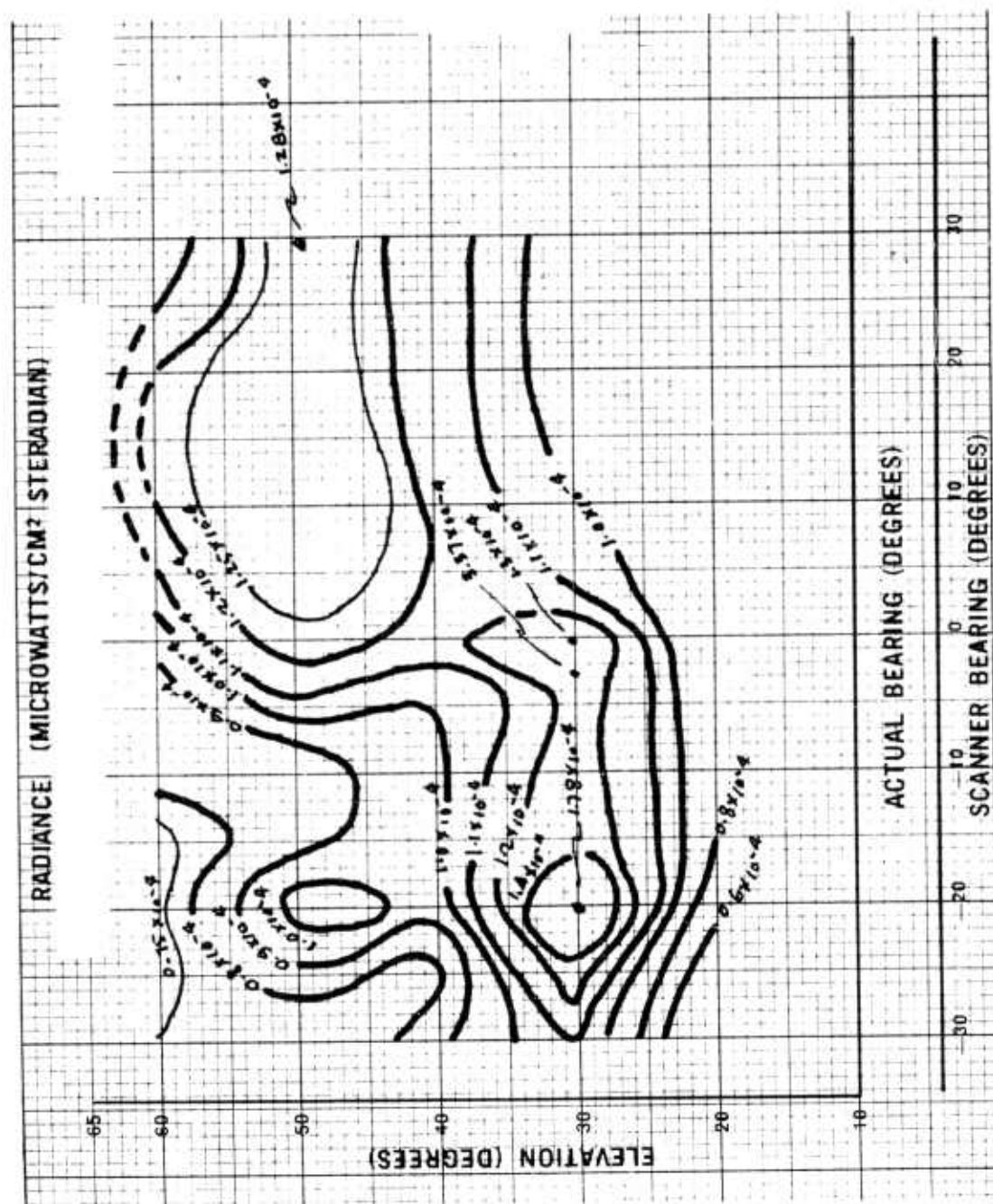


Figure 3.193 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 2,219 seconds.

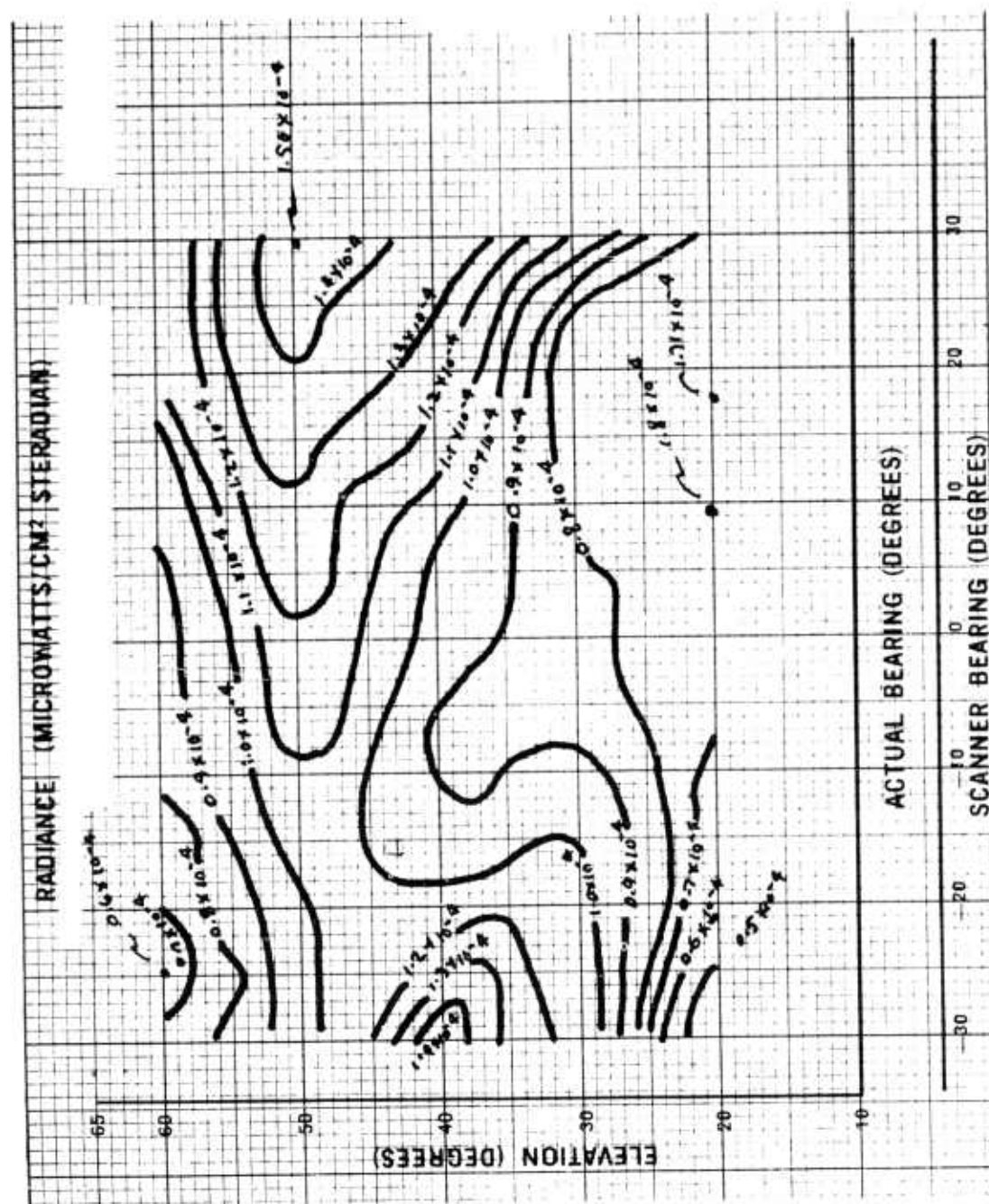


Figure 3.194 Sky radiance, Kettle I, Check Mate, 0.420 to 0.456 microns, H + 2,762 seconds.

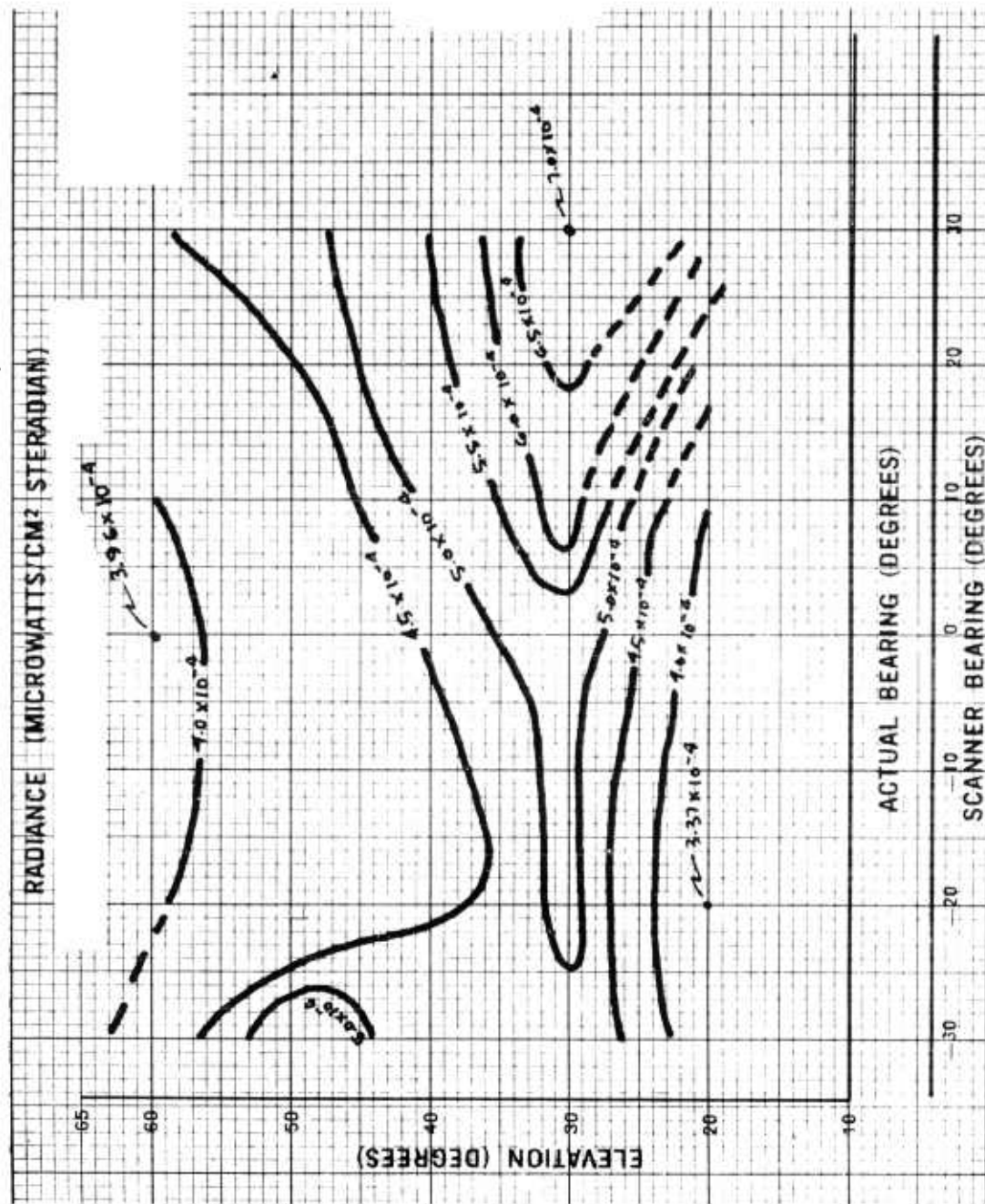


Figure 3.195 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H-275 seconds.



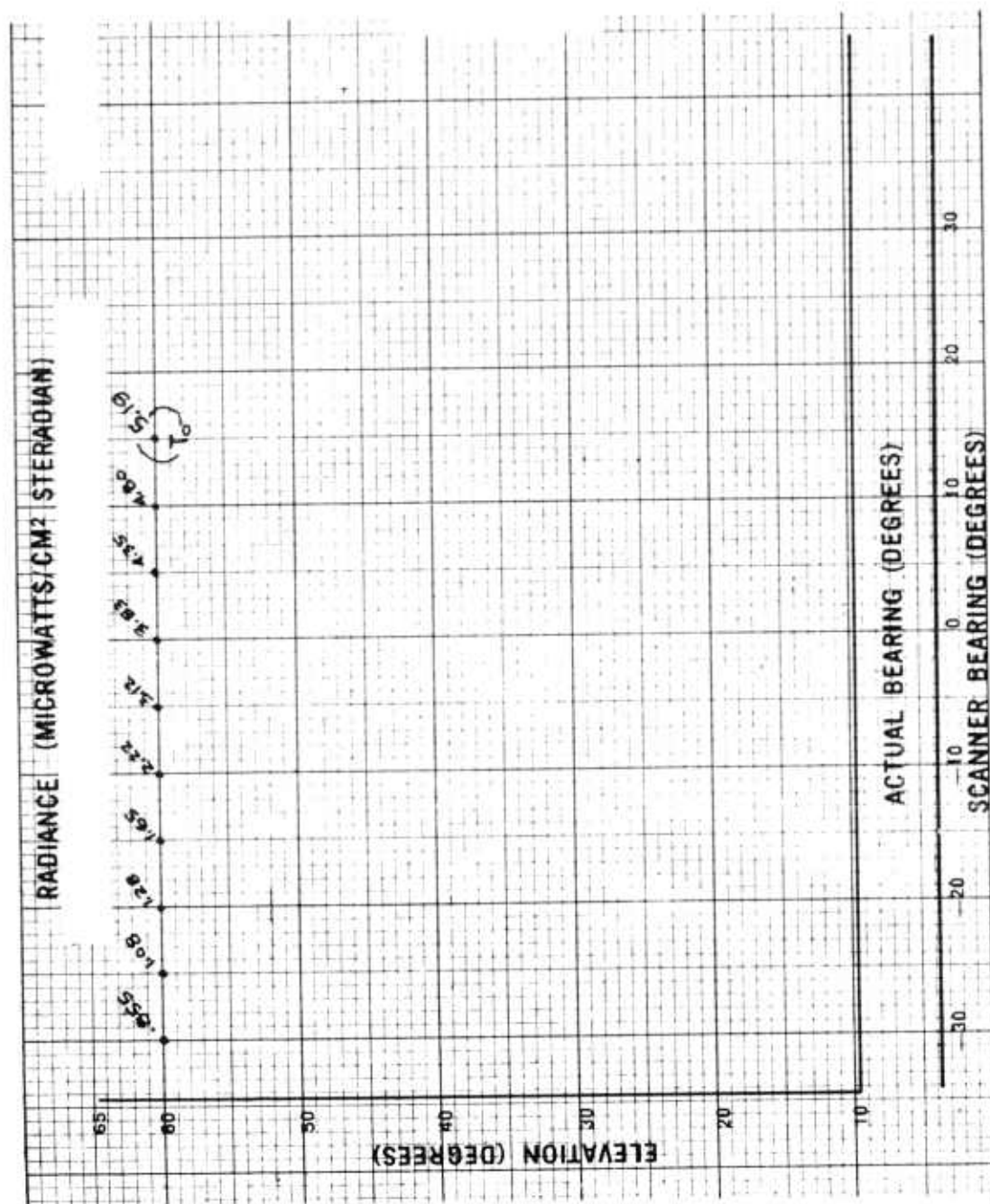
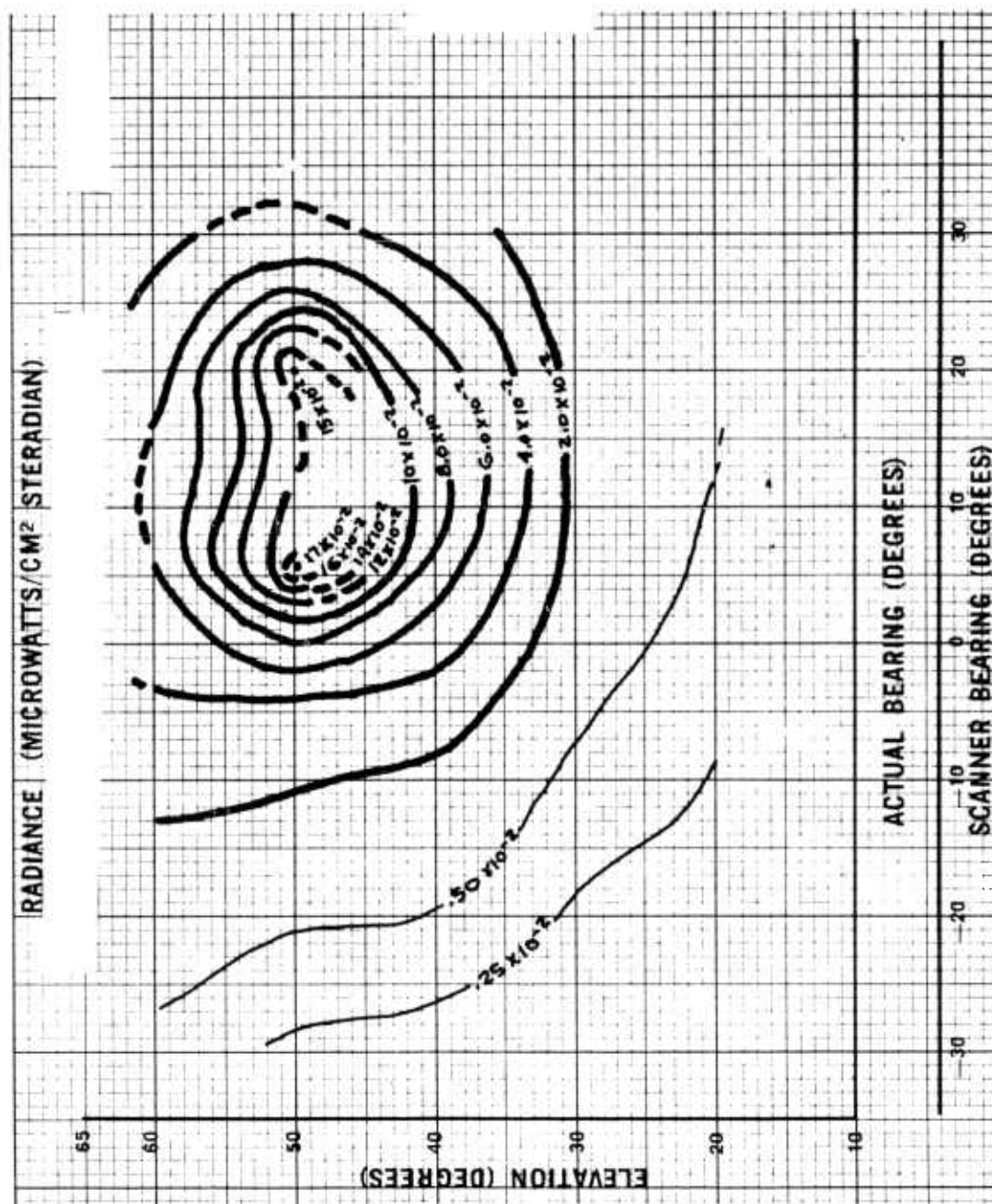
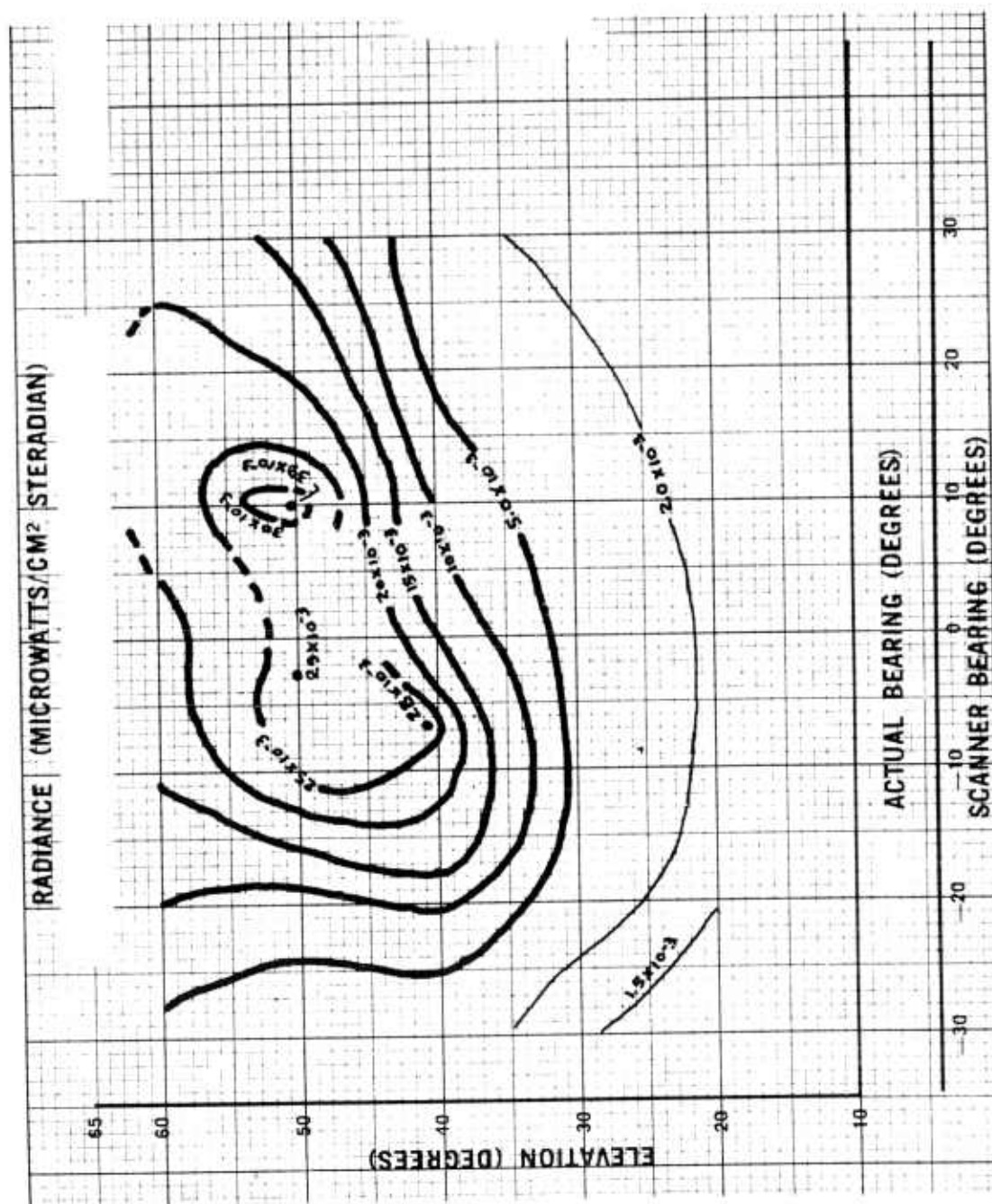
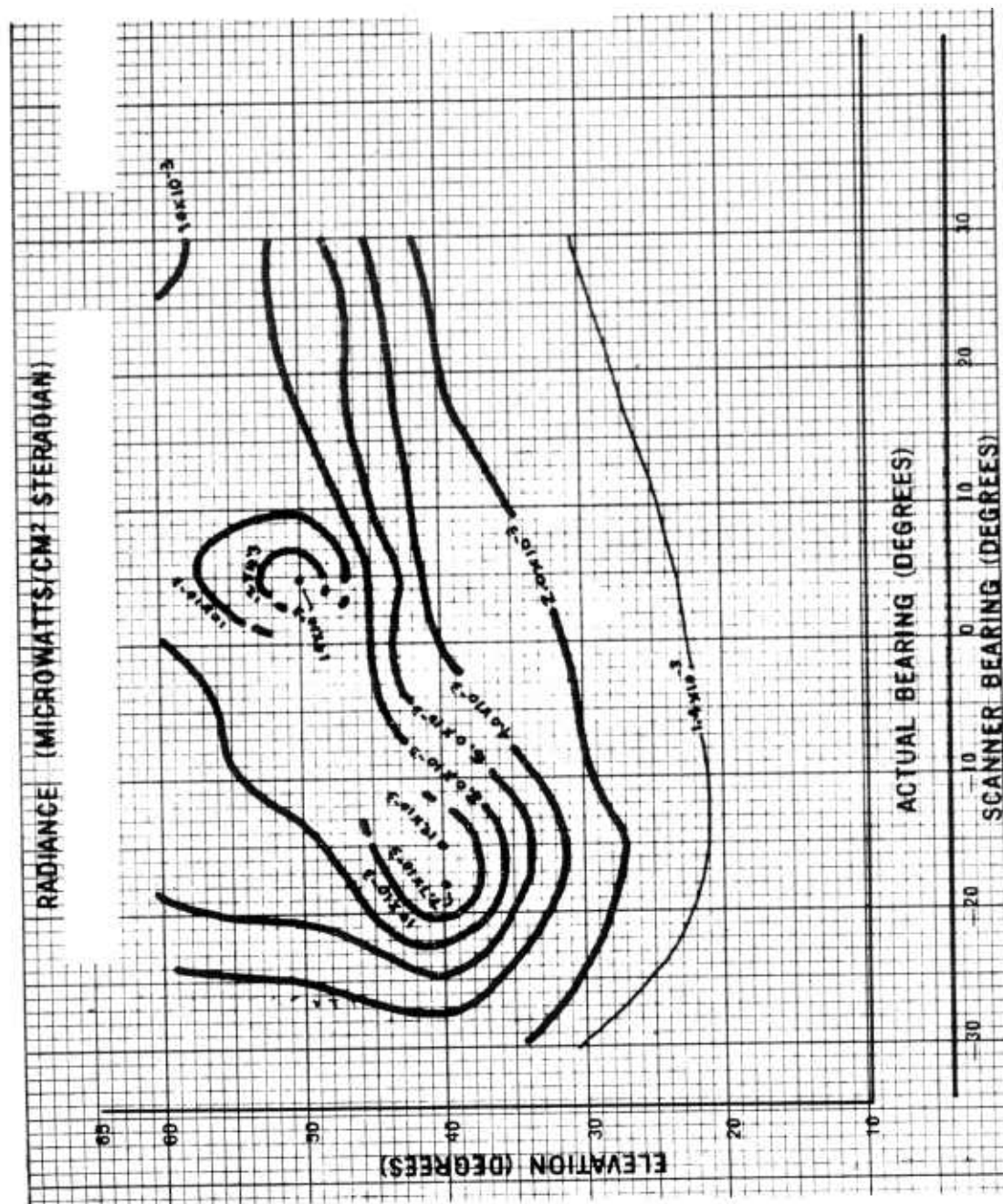


Figure 3.196 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H-4 seconds.









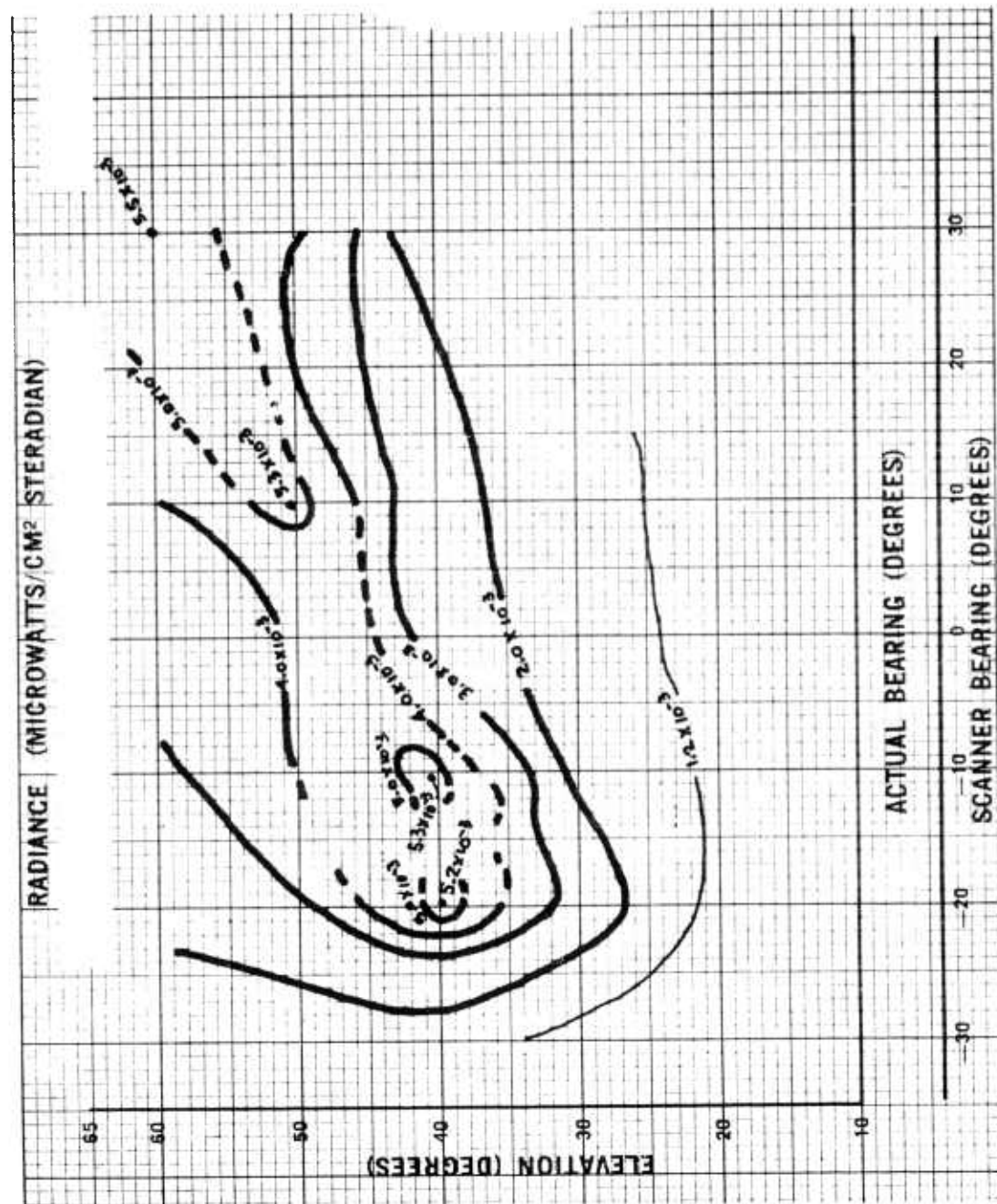


Figure 3.200 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H+334 seconds.

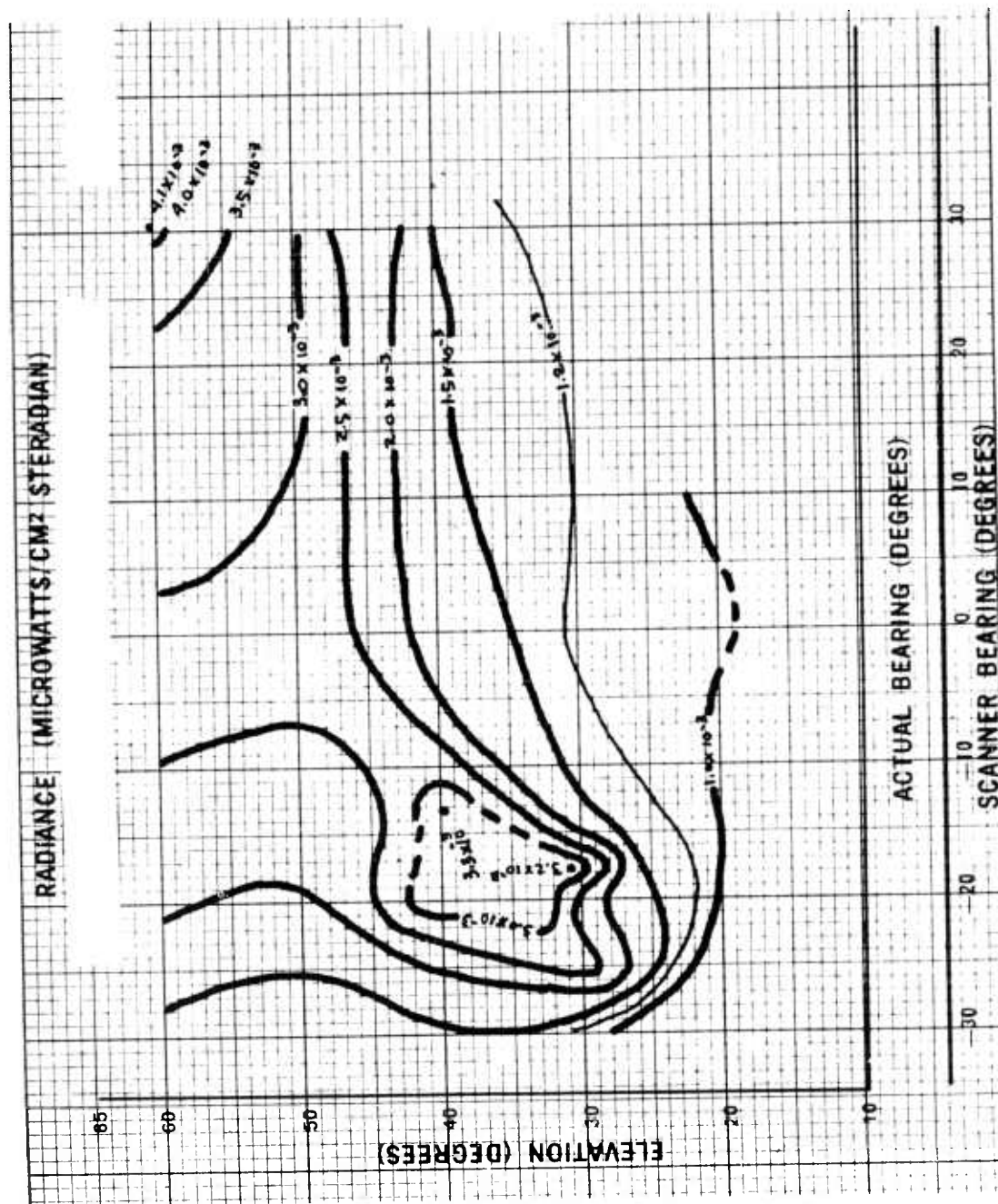


Figure 3.201 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 402 seconds.

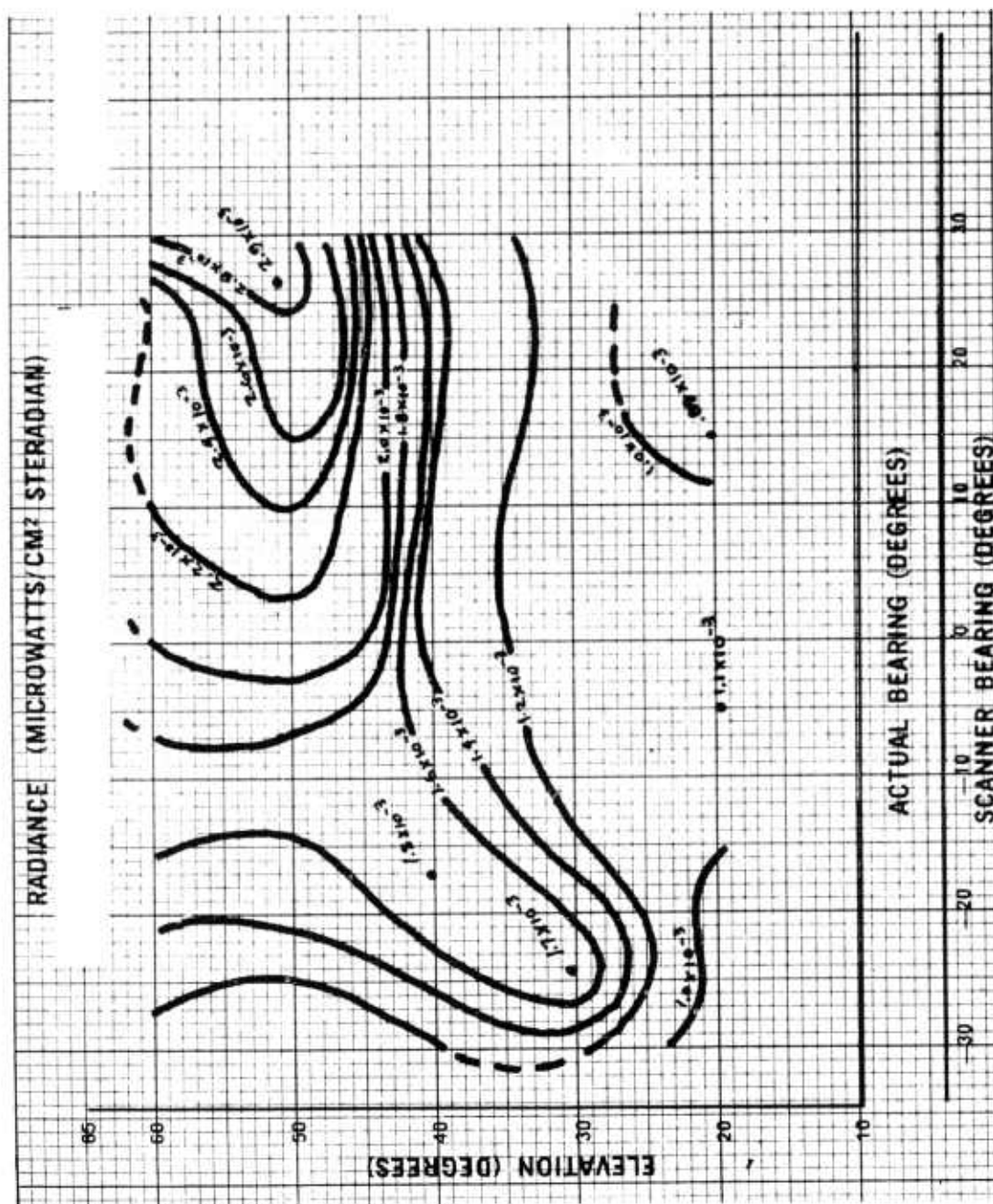
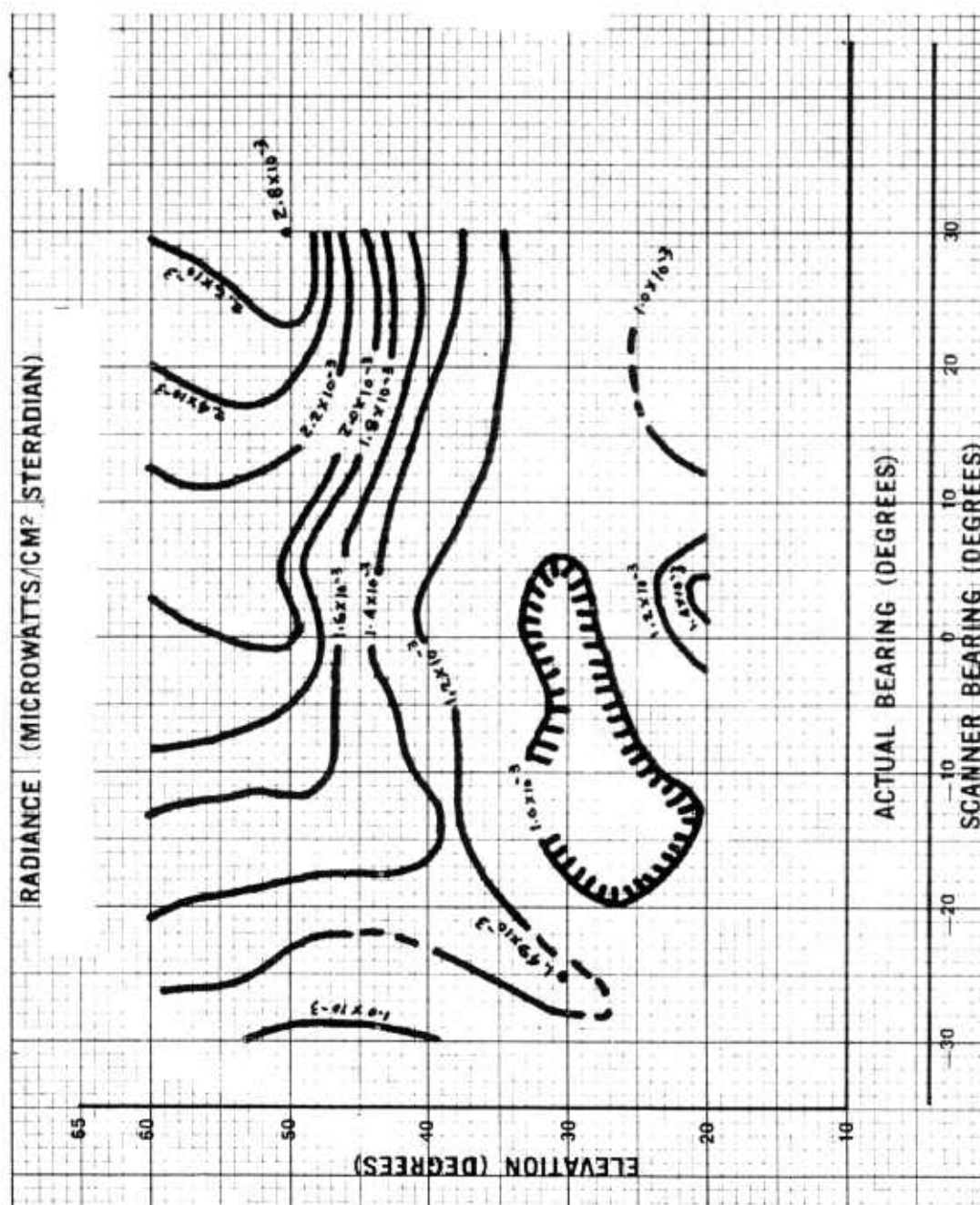


Figure 3.202 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 470 seconds.





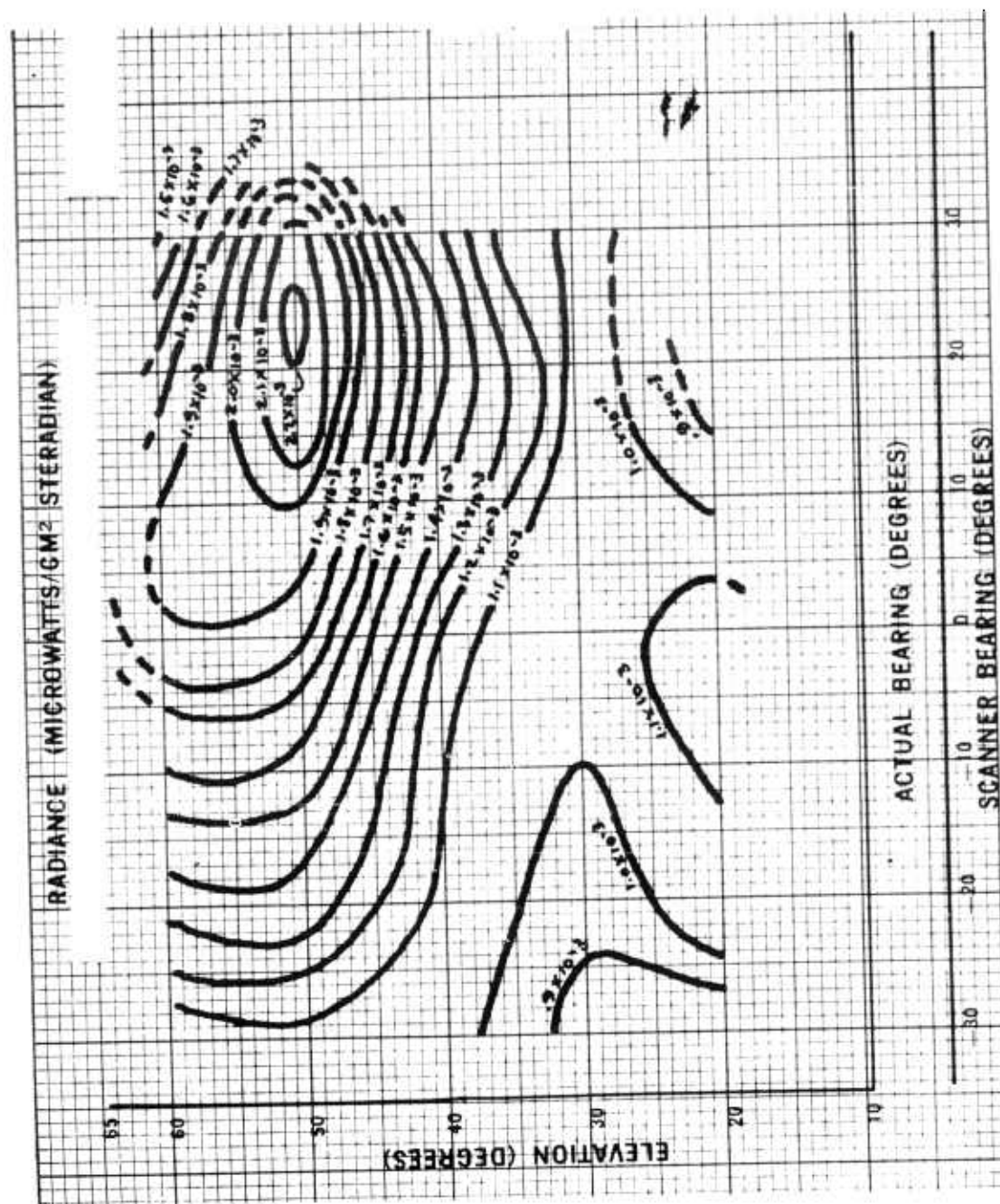


Figure 3.204 Sky radiance, Kettle 1, Check Mate, 0.358 to 0.558 microns, H + 605 seconds.

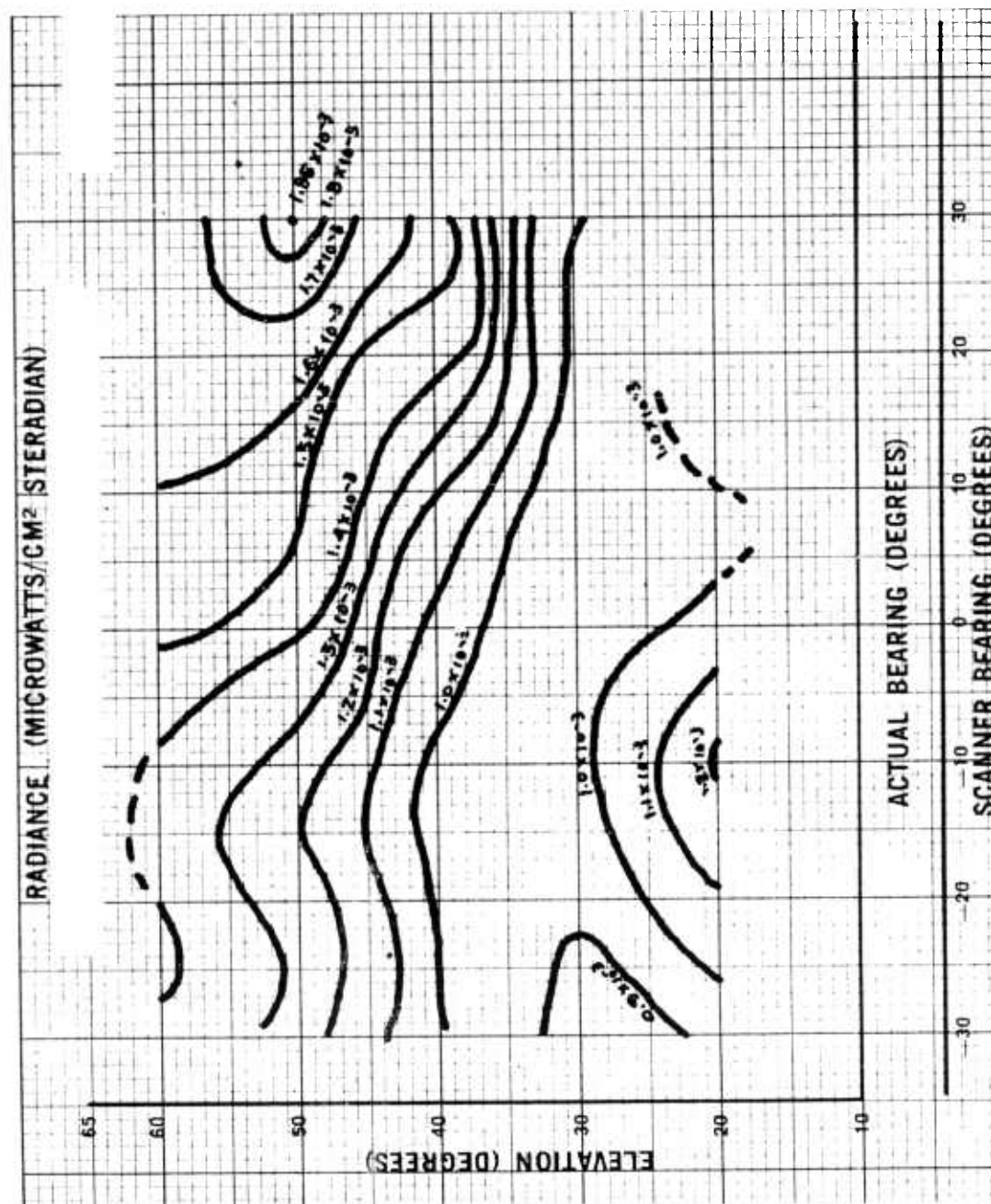


Figure 3.205 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 673 seconds.

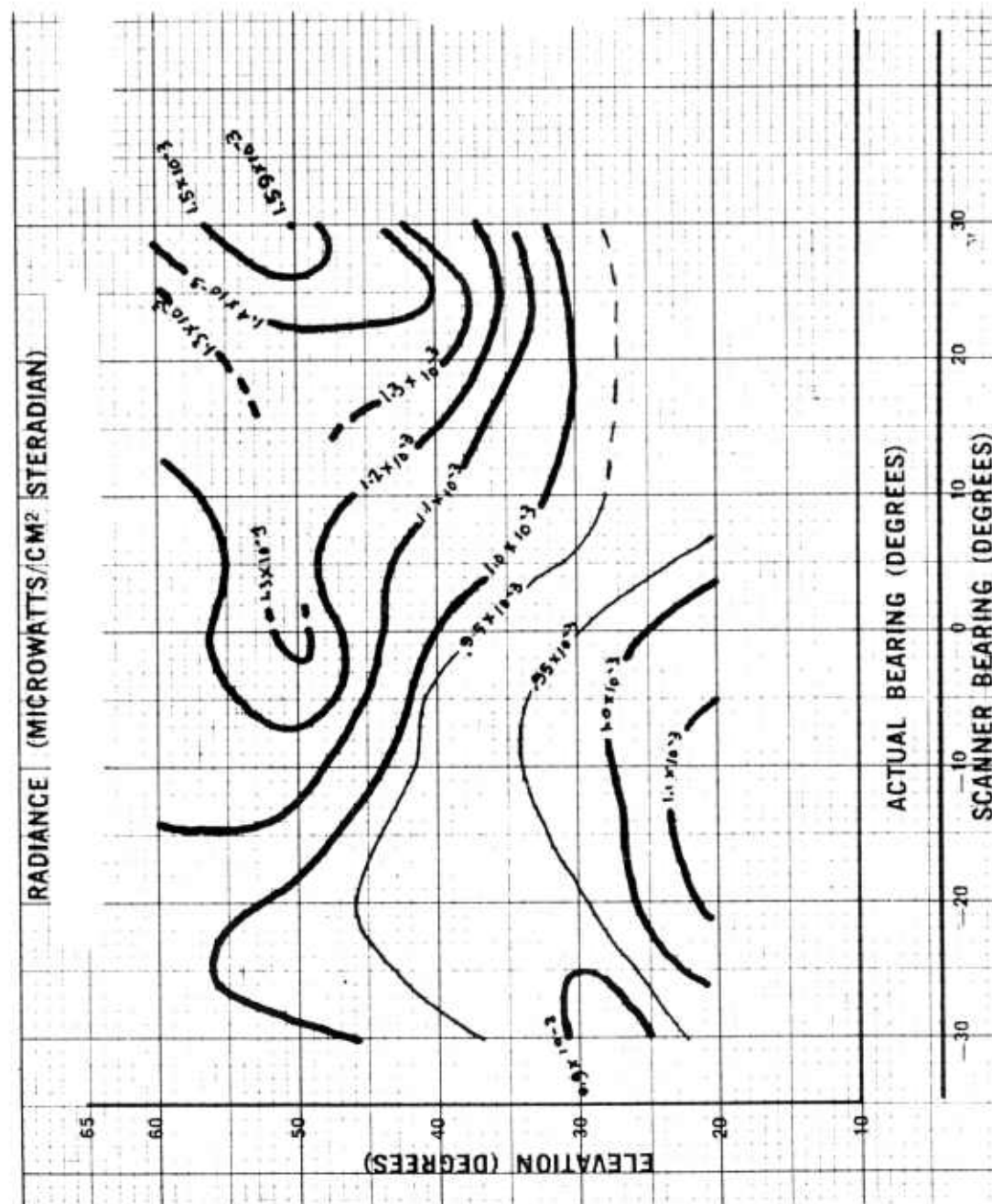


Figure 3.206 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 740 seconds.



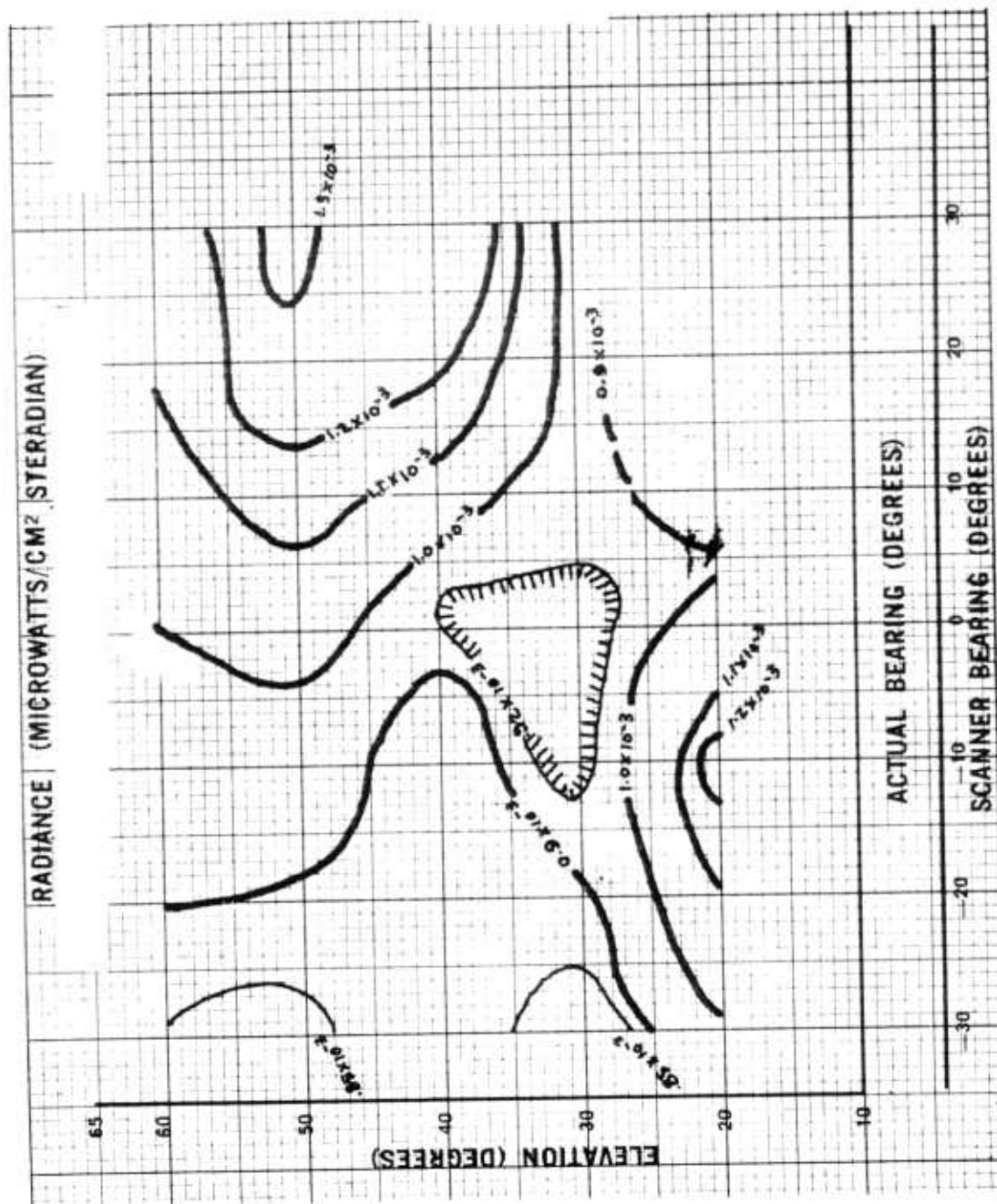


Figure 3.207 Sky radiance, Kettle 1, Check Mate, 0.358 to 0.558 microns, H + 808 seconds.

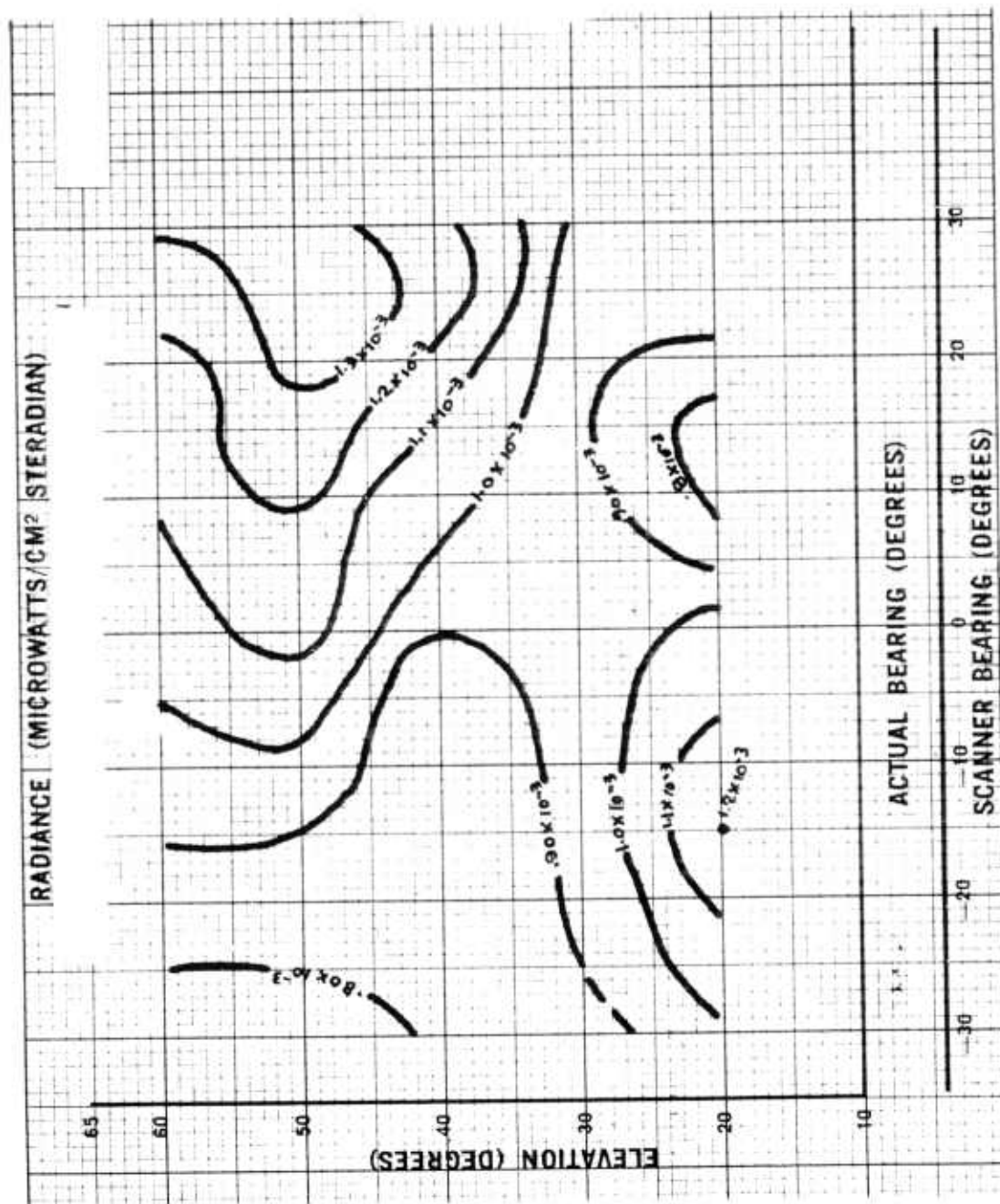


Figure 3.208 Sky radiance, Kettle 1, Check Mate, 0.358 to 0.558 microns, H+876 seconds.

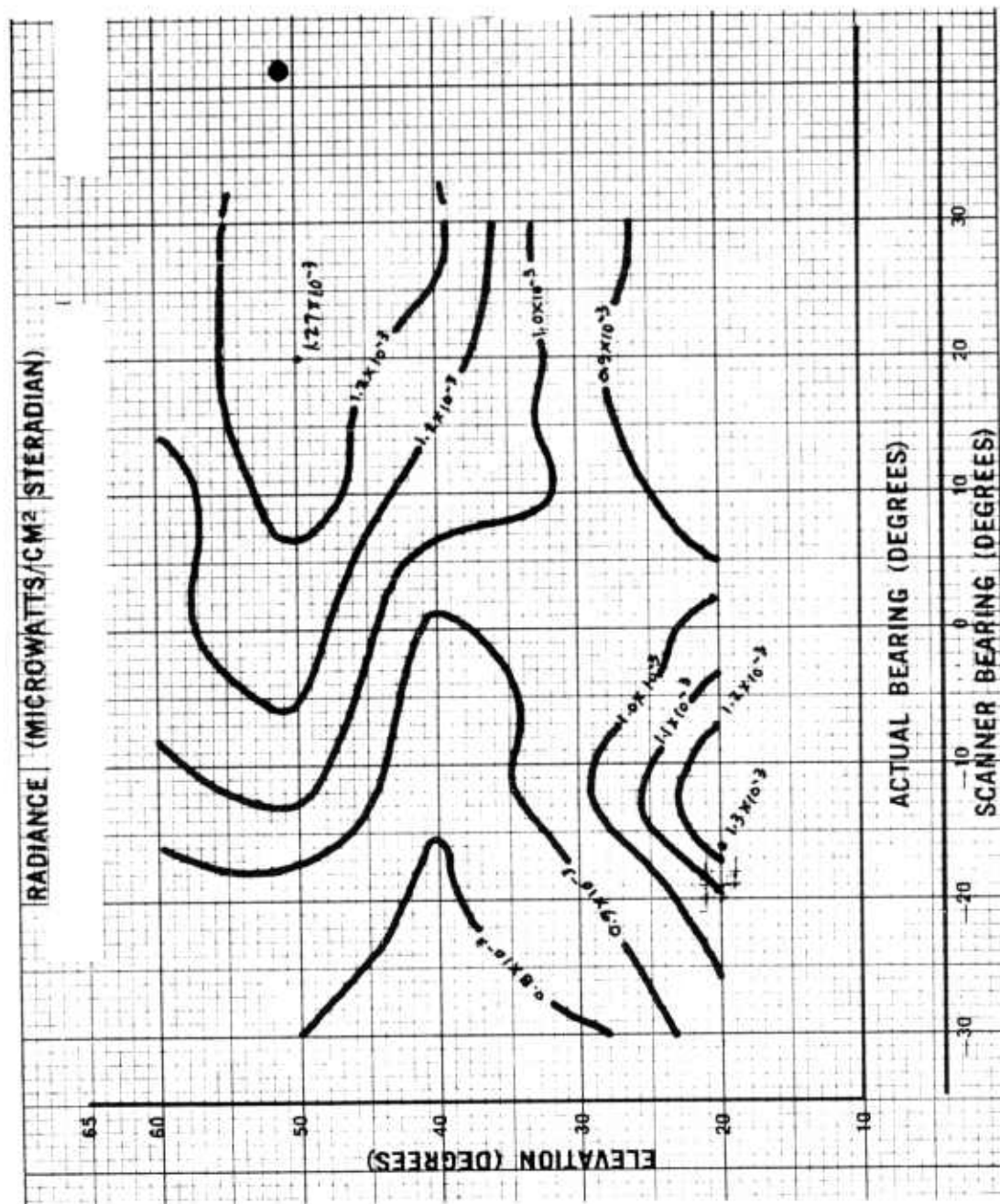


Figure 3.209 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H+943 seconds.

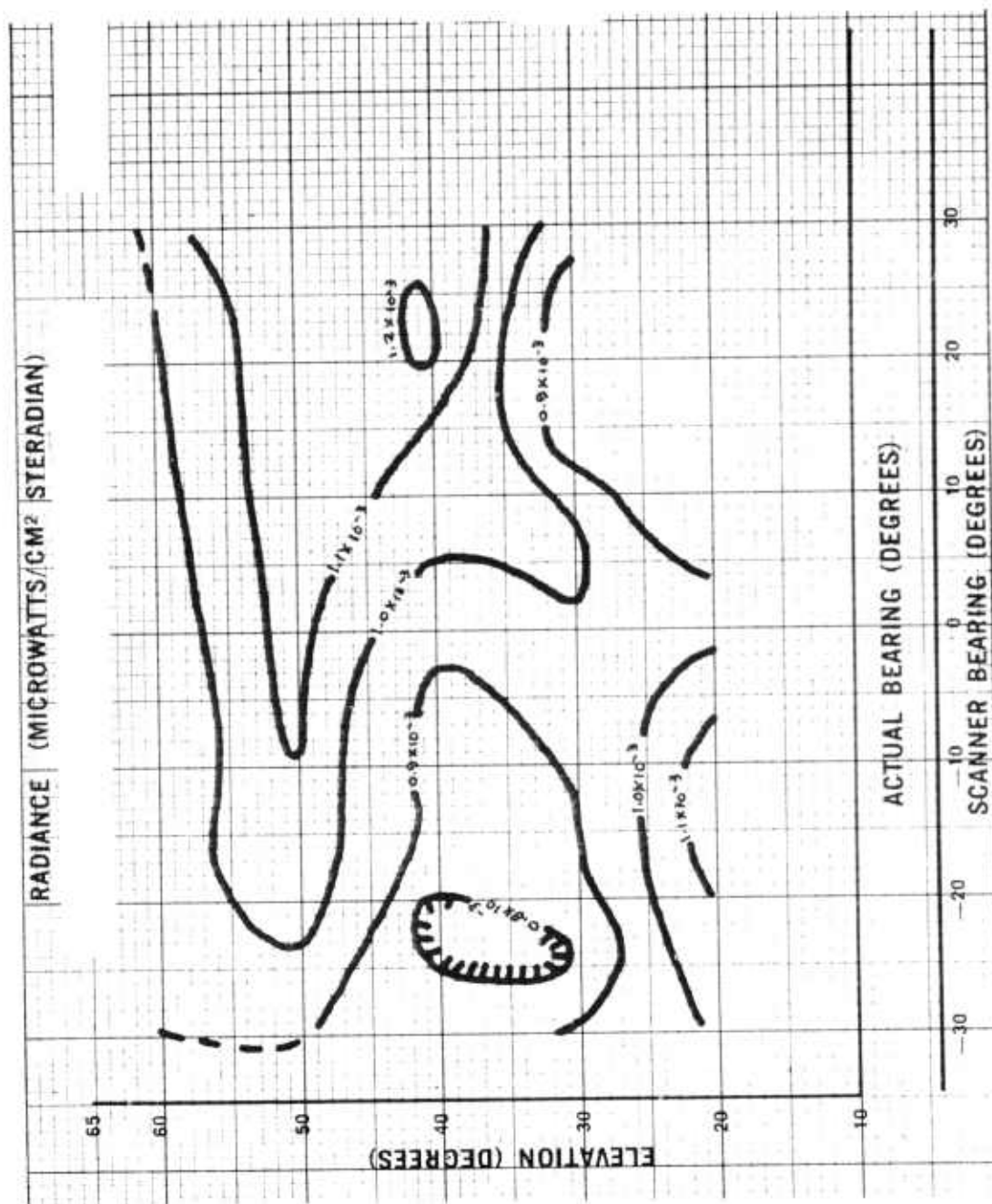


Figure 3.210 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H+1,011 seconds.

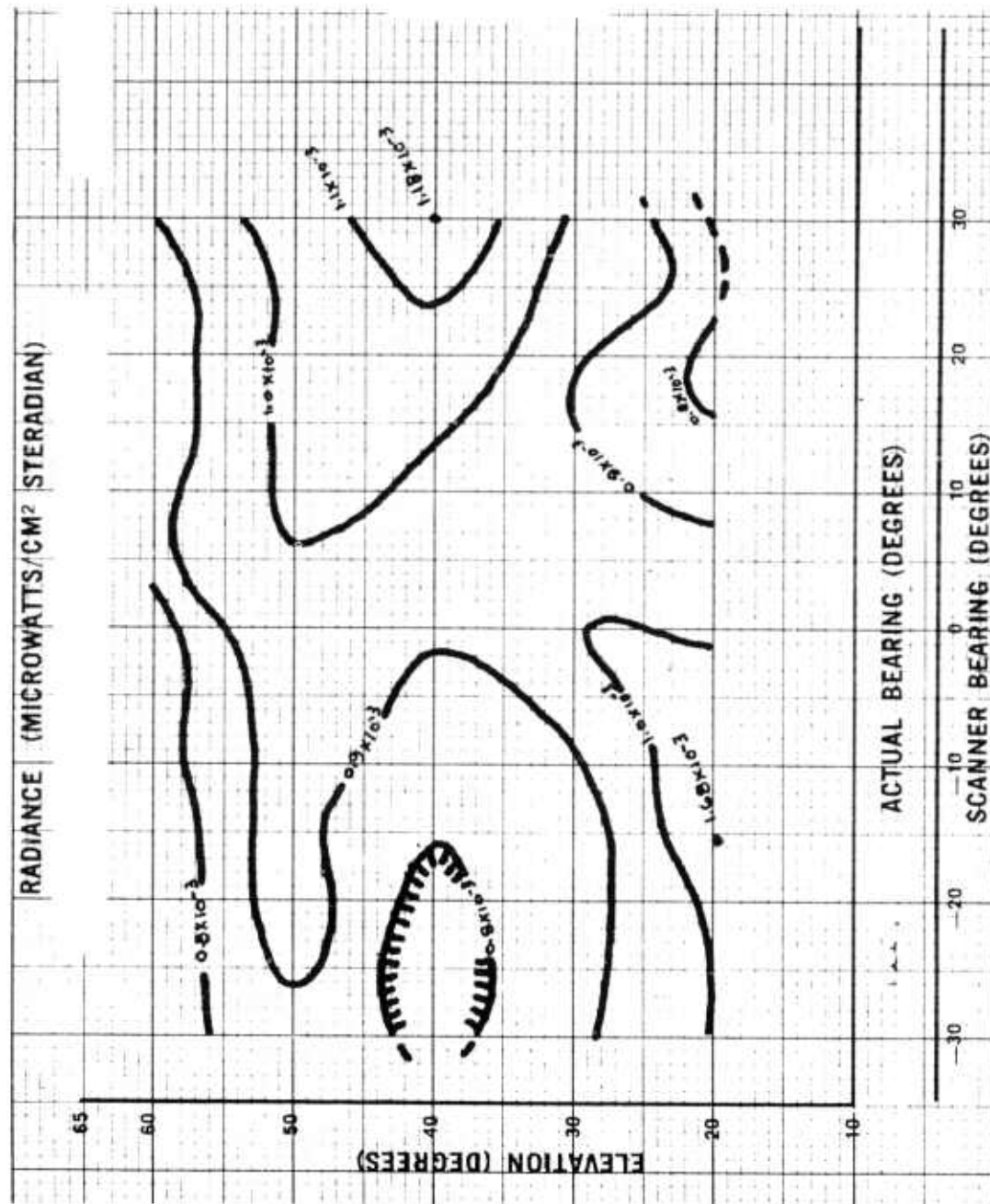


Figure 3.211 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 1.147 seconds.



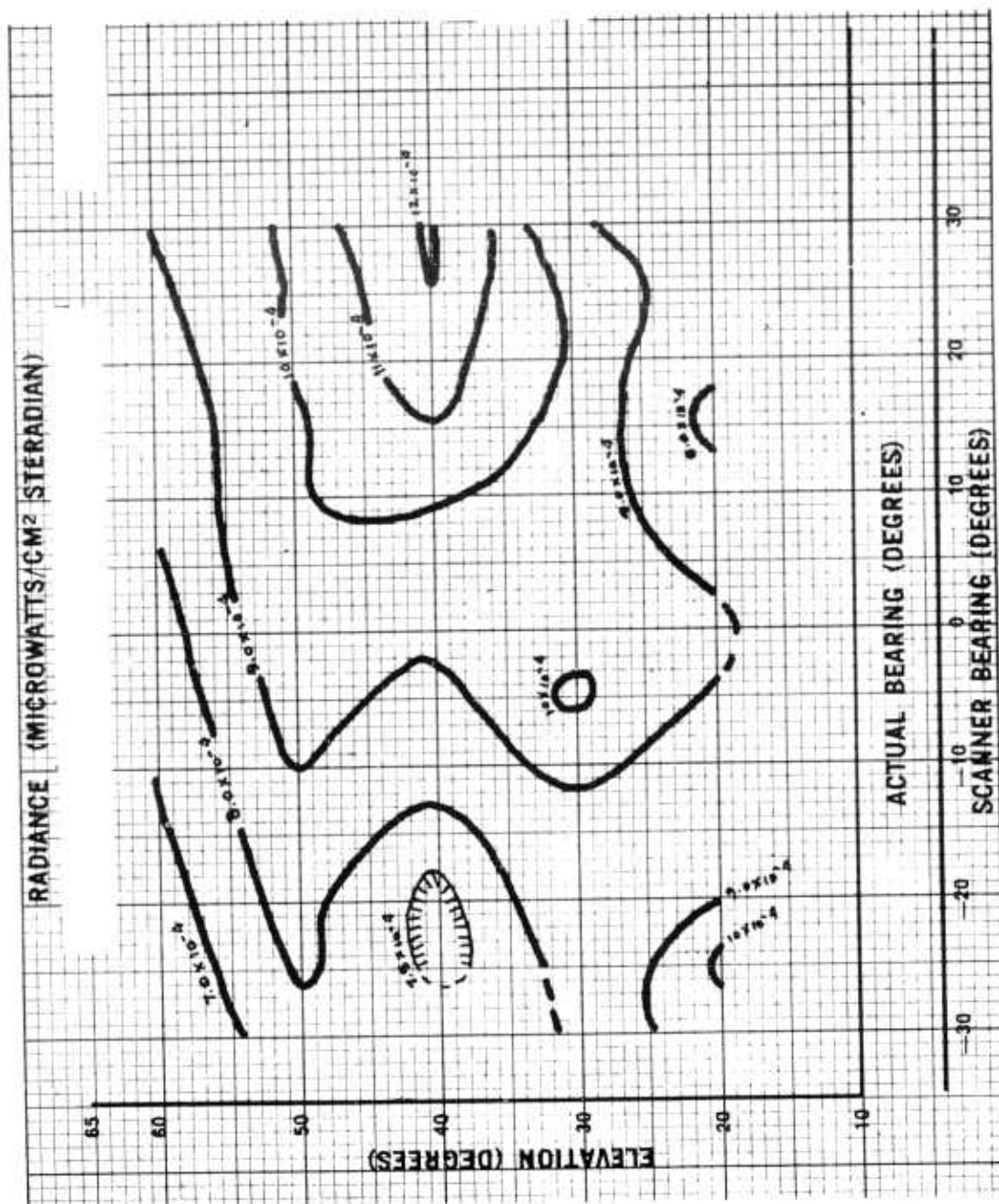


Figure 3.212 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 1,282 seconds.

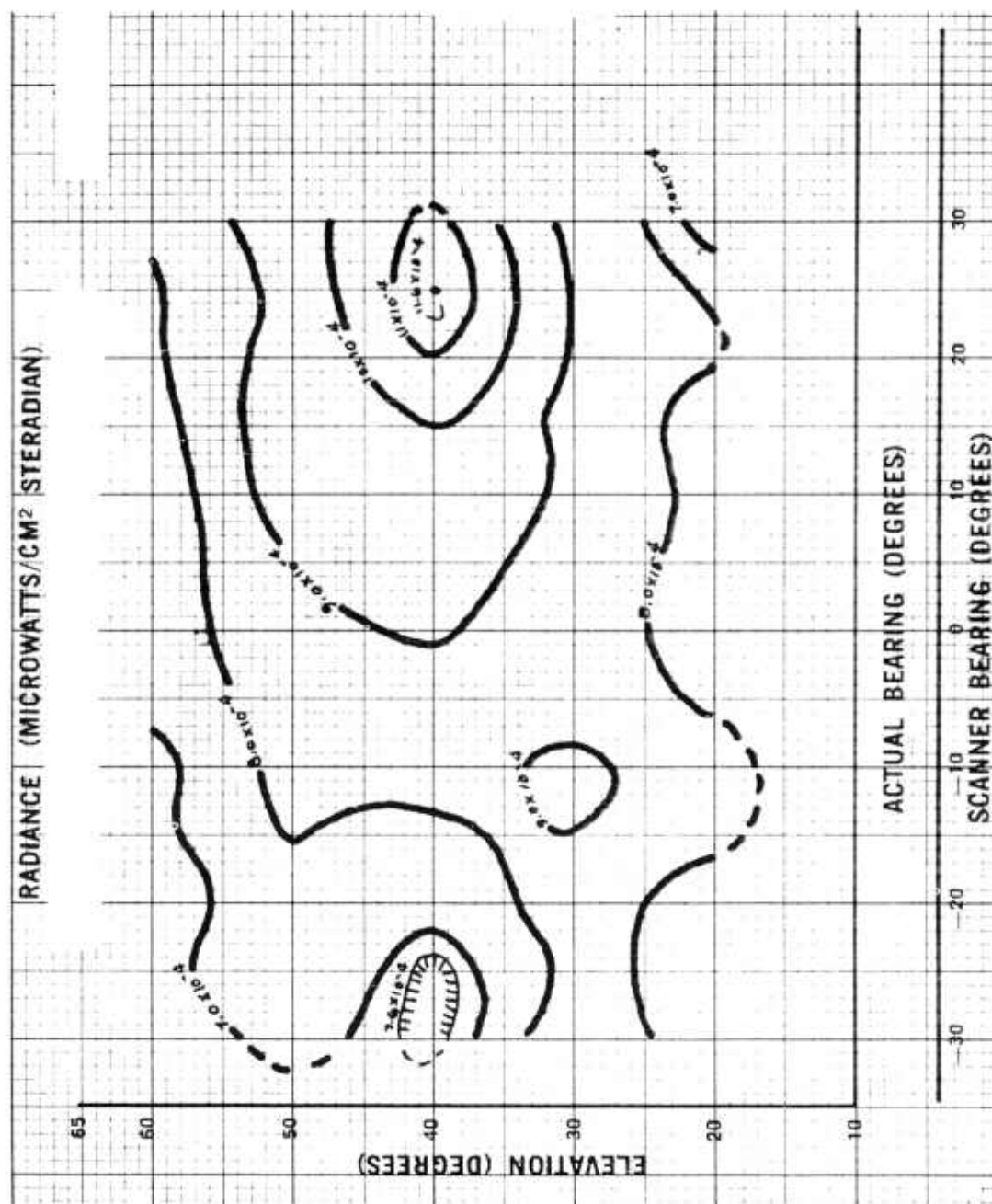


Figure 3.213 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H+1,417 seconds.

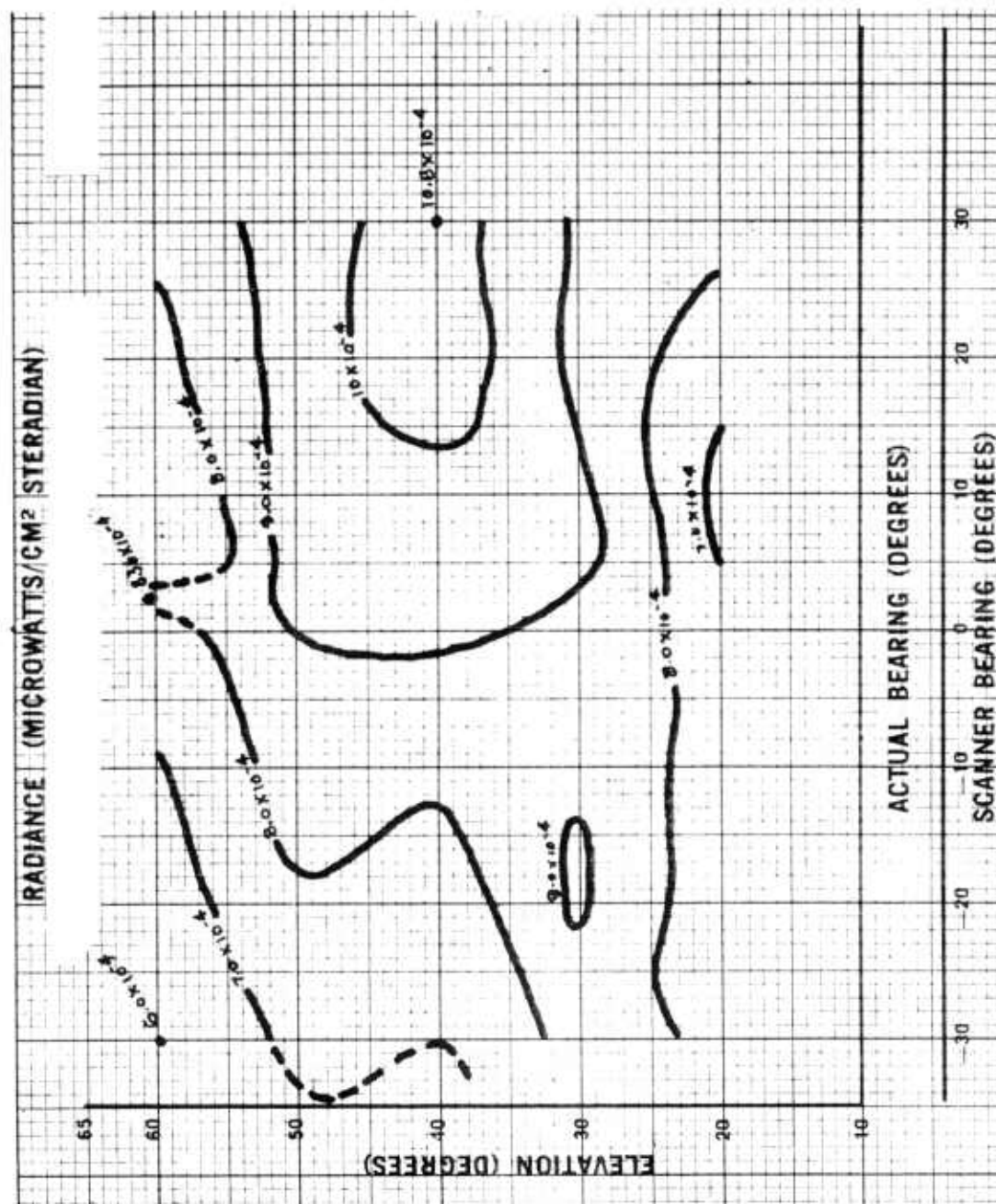


Figure 3.214 Sky radiance, Kettle 1, Check Mate, 0.358 to 0.558 microns, H + 1,553 seconds.



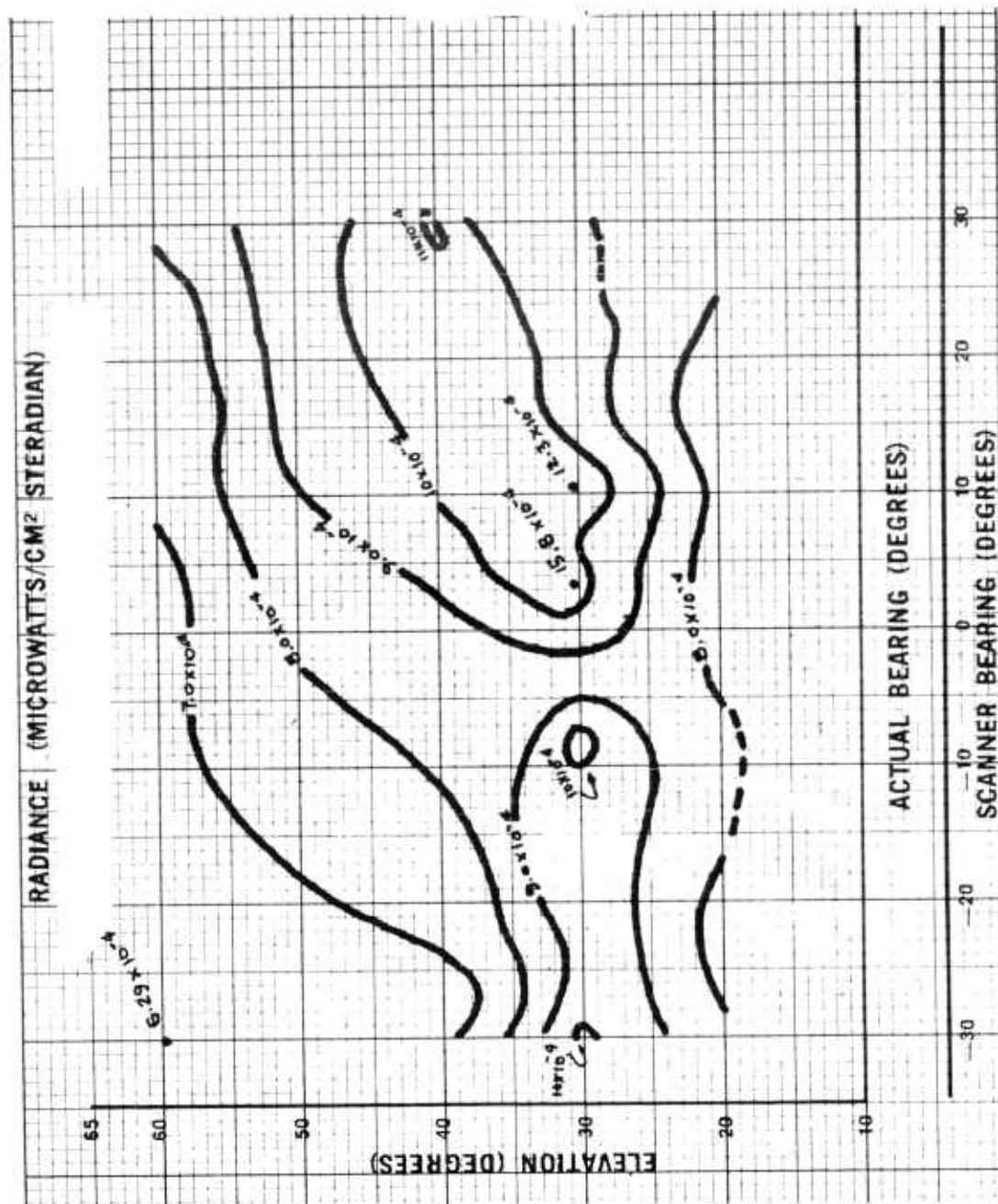


Figure 3.215 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 1,688 seconds.

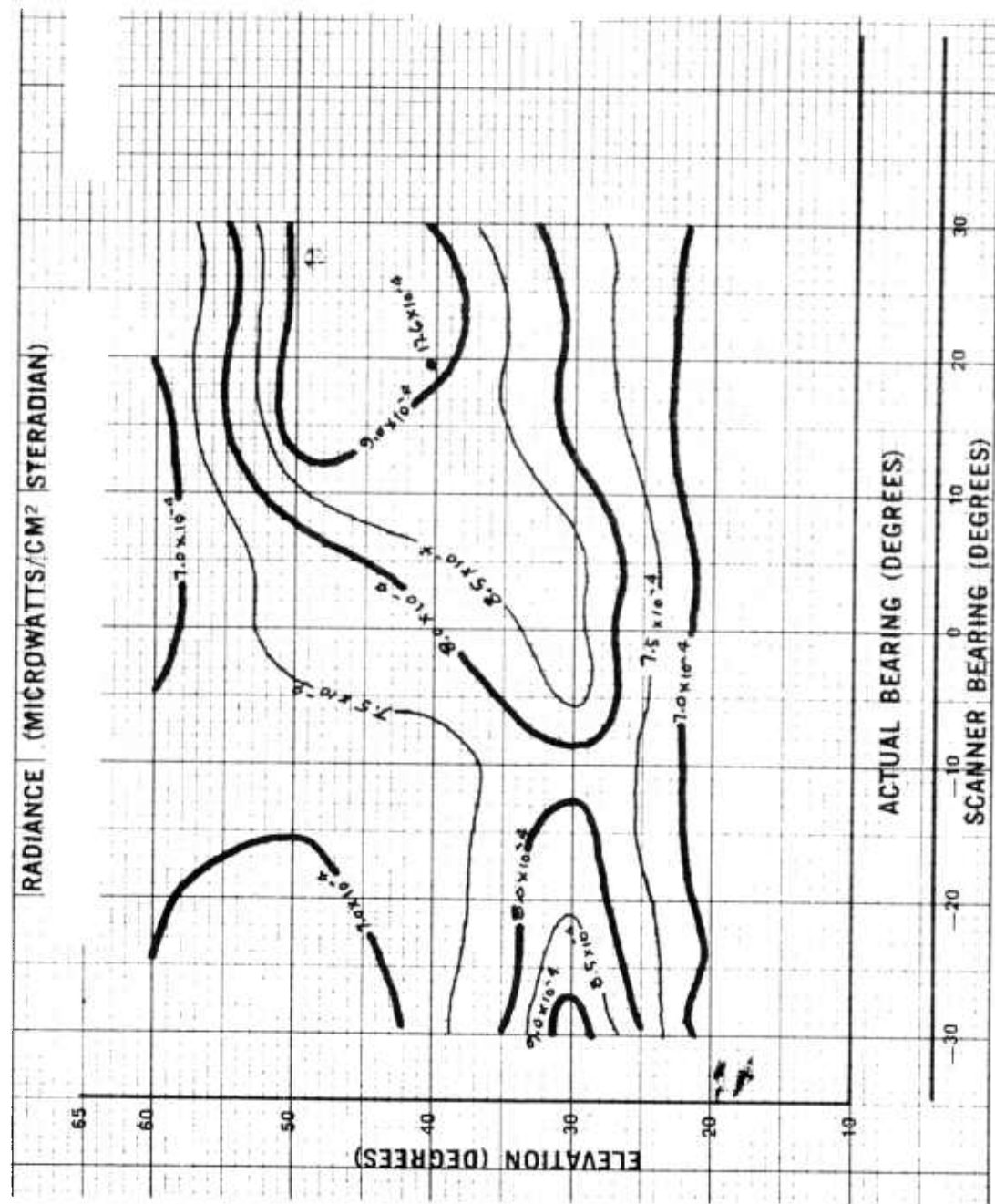
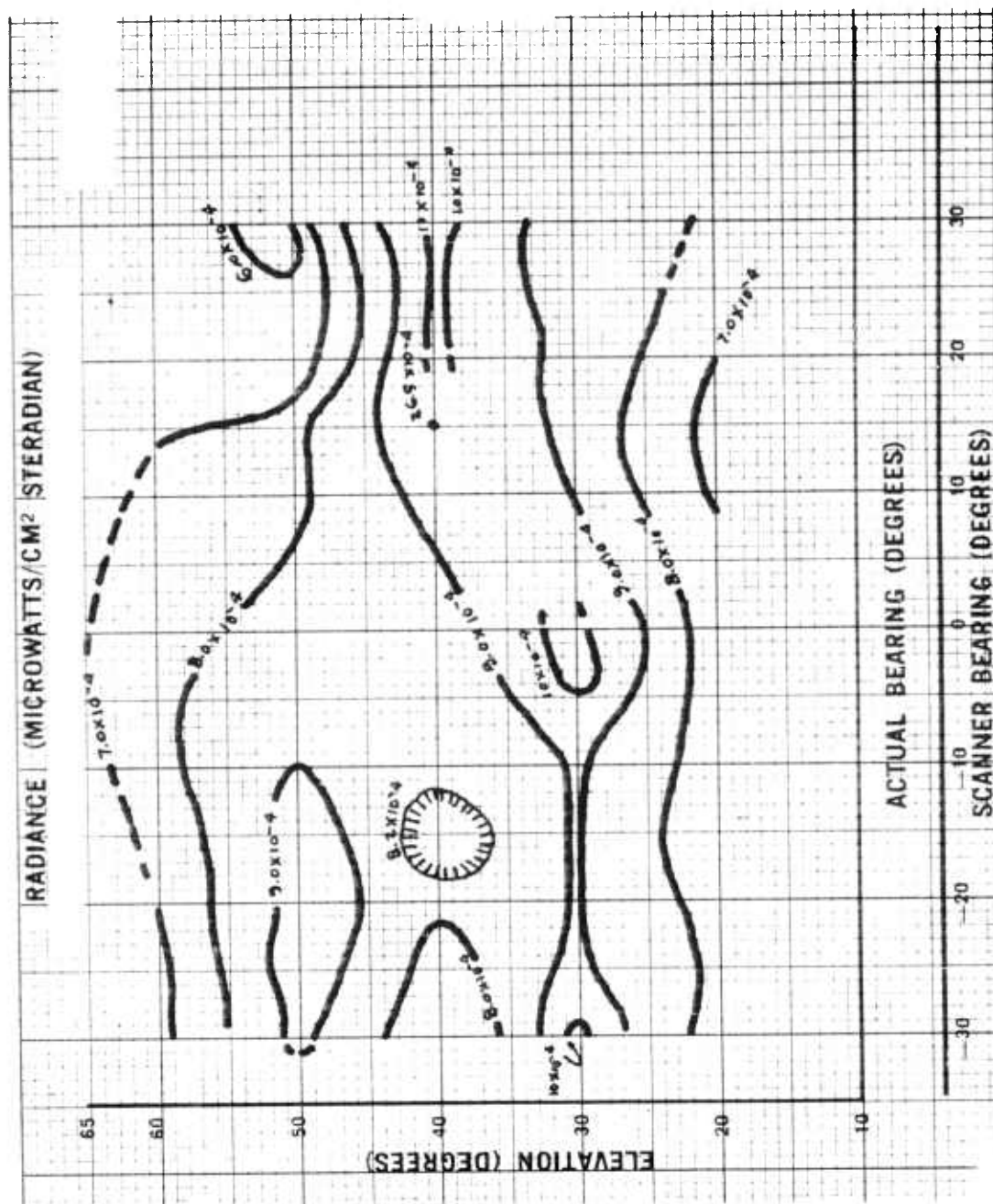


Figure 3-216 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 1,824 seconds.



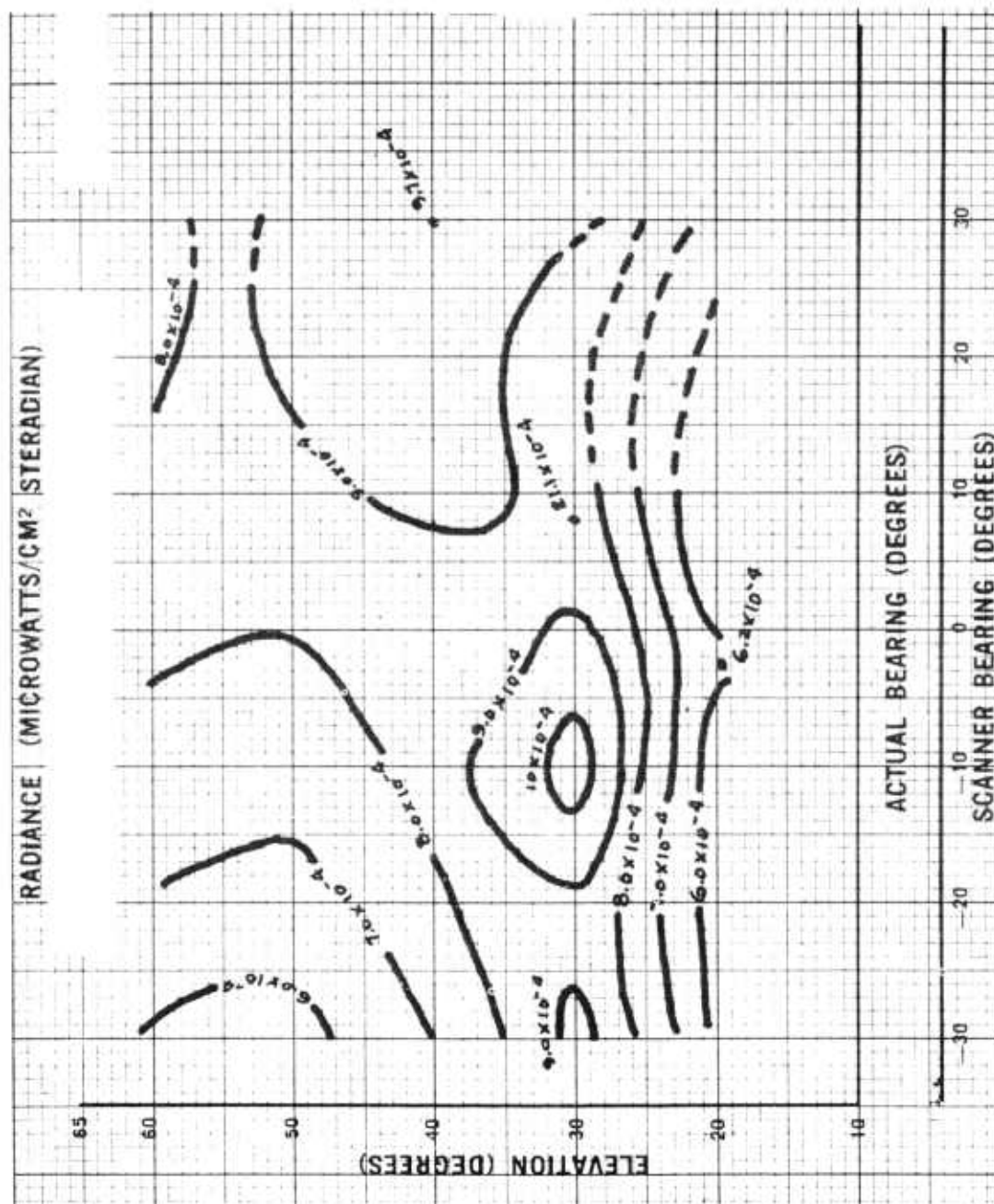


Figure 3.218 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 2.095 seconds.

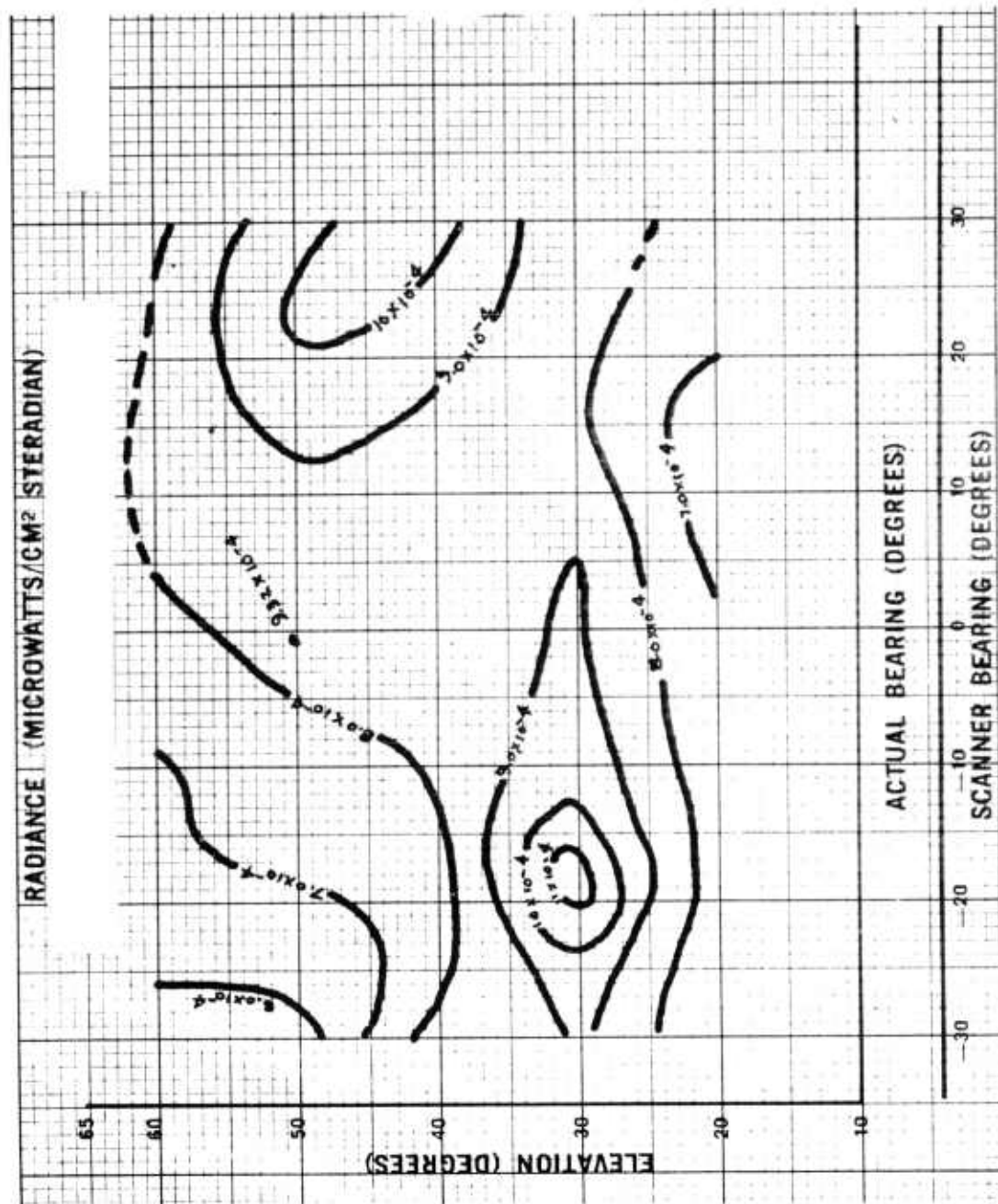


Figure 3.219 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 2,230 seconds.

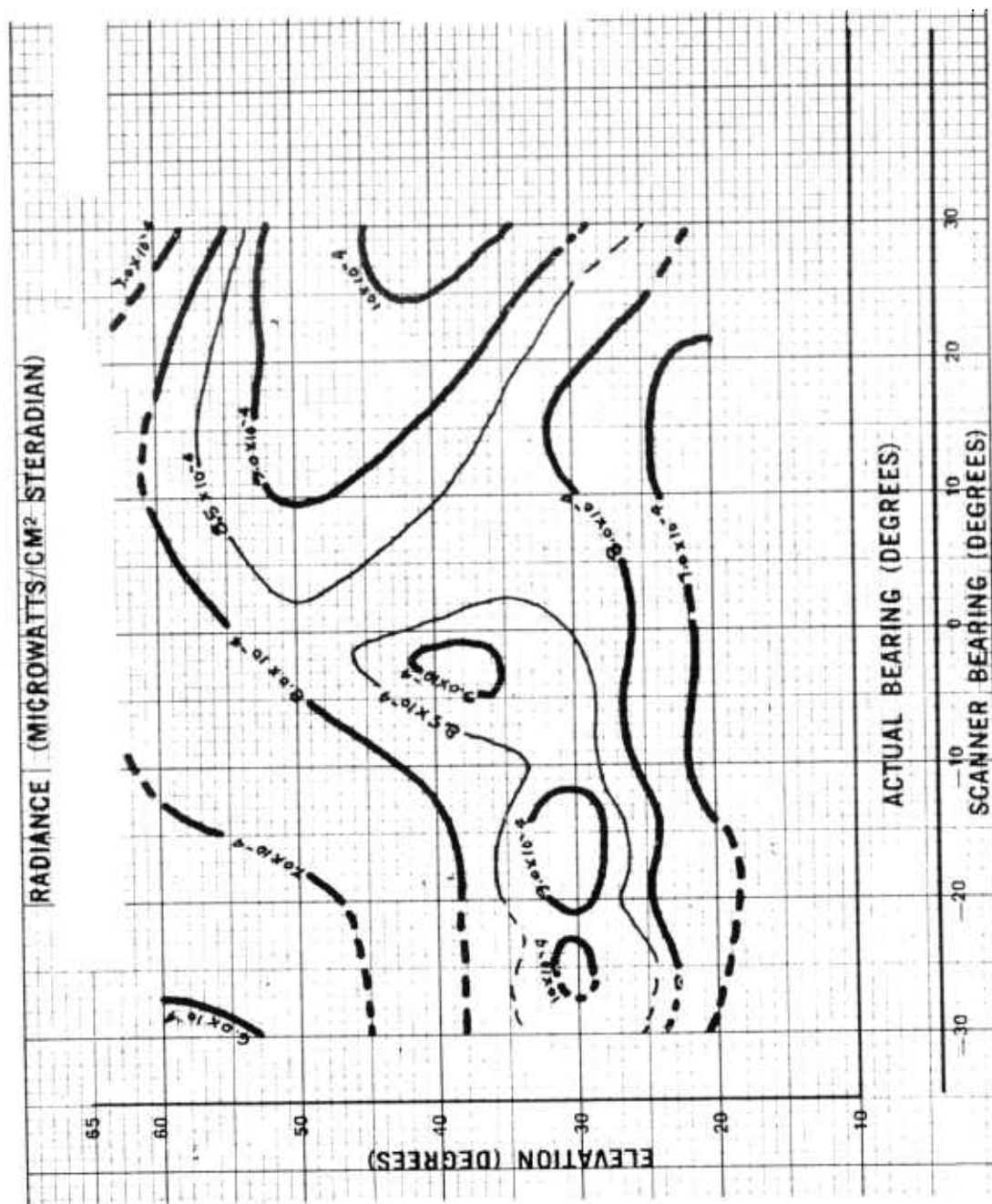


Figure 3.220 Sky radiance, Kettle 1, Check Mate, 0.358 to 0.558 microns, H + 2,366 seconds.



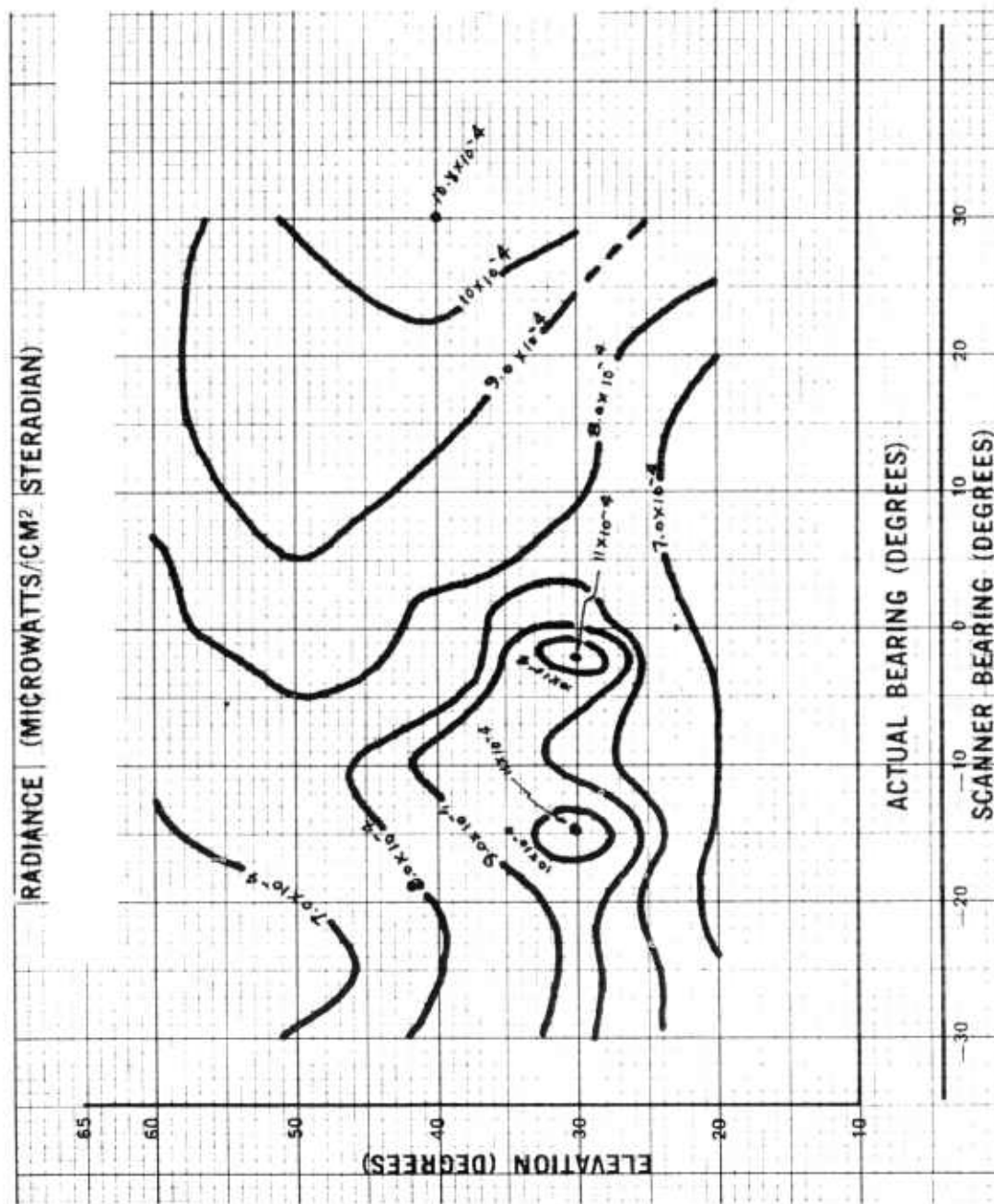


Figure 3.221 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 2.502 seconds.

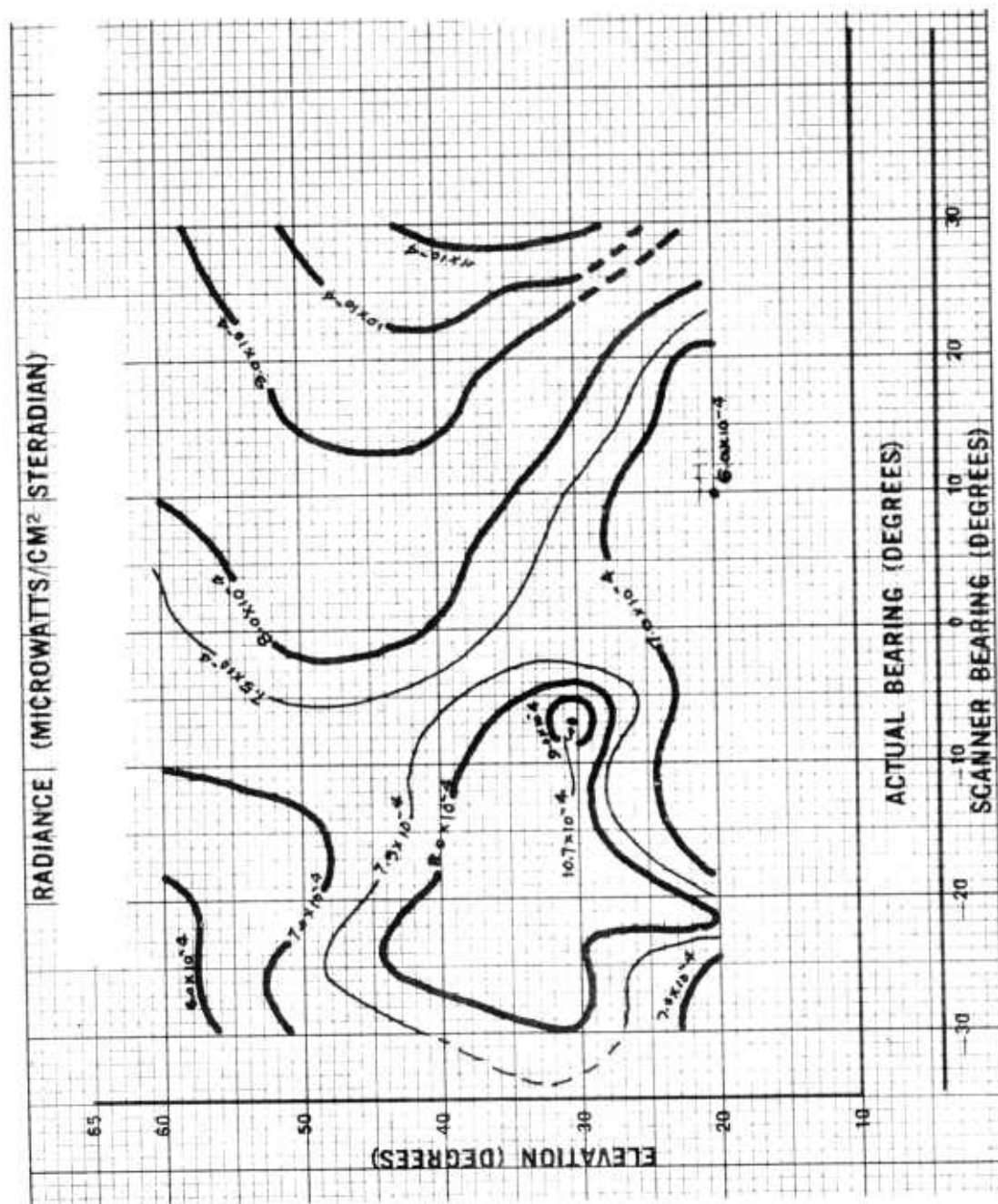
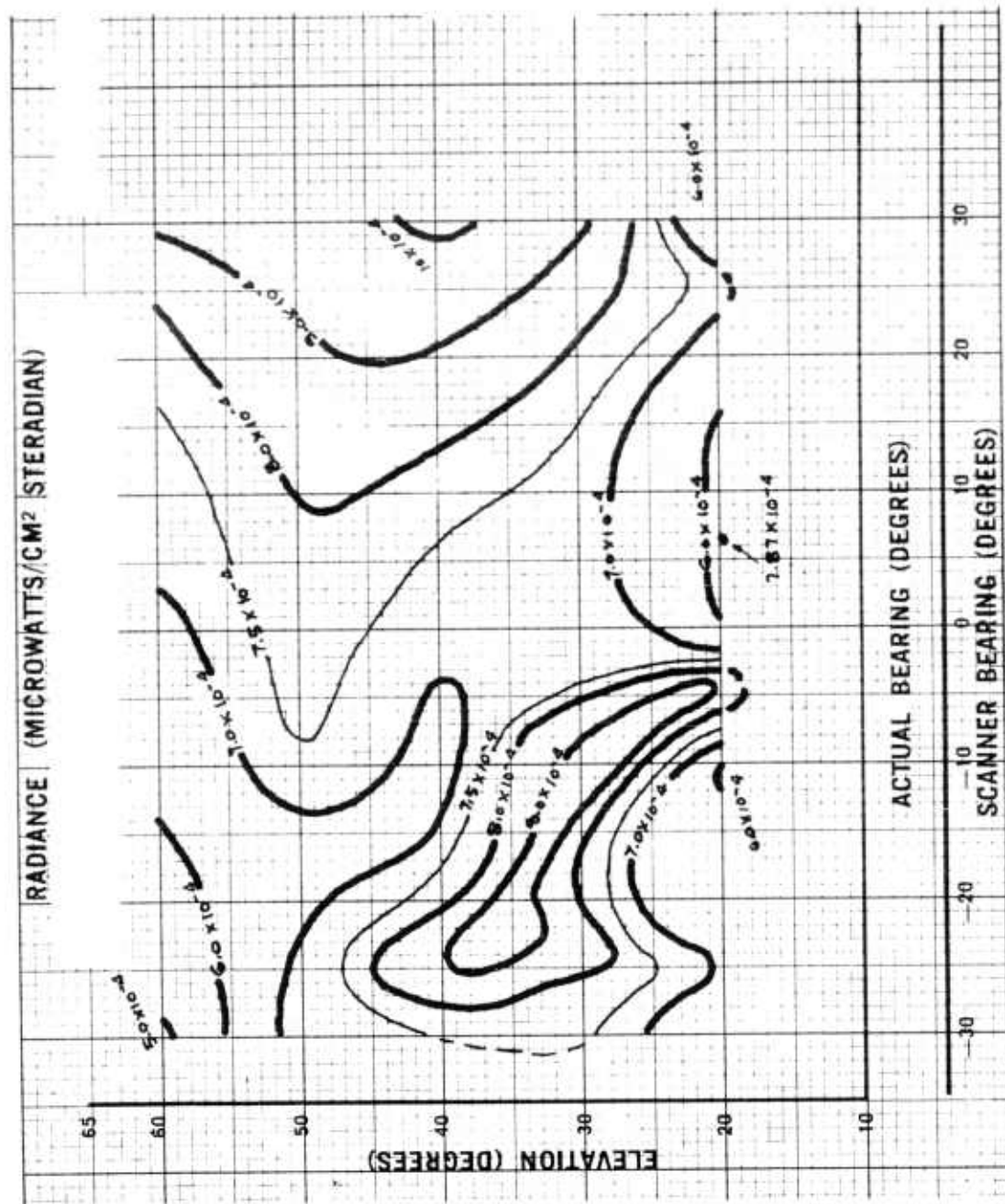


Figure 3.222 Sky radiance, Kettle I, Check Mate, 0.358 to 0.558 microns, H + 2.637 seconds.





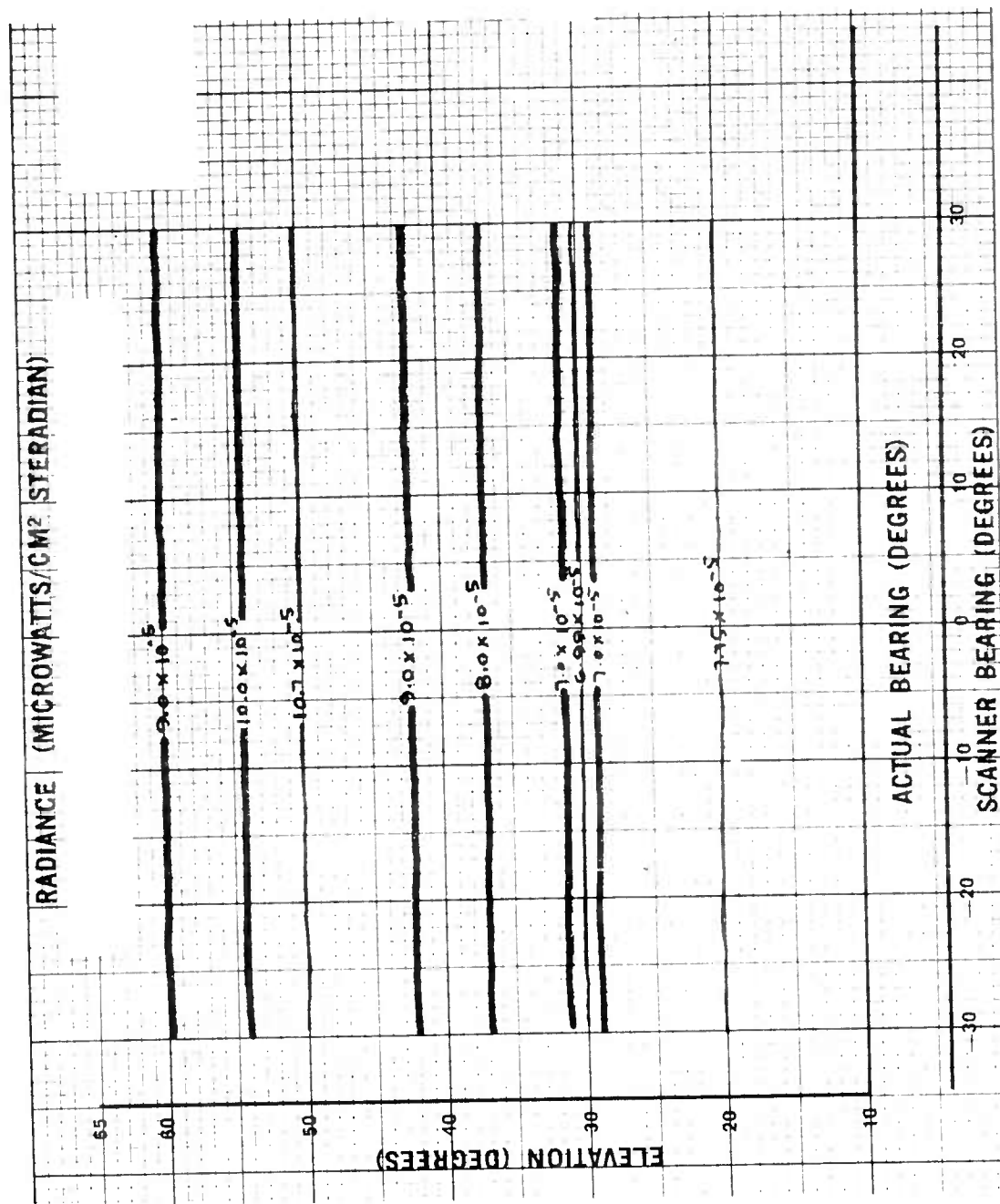


Figure 3.224 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H-264 seconds.

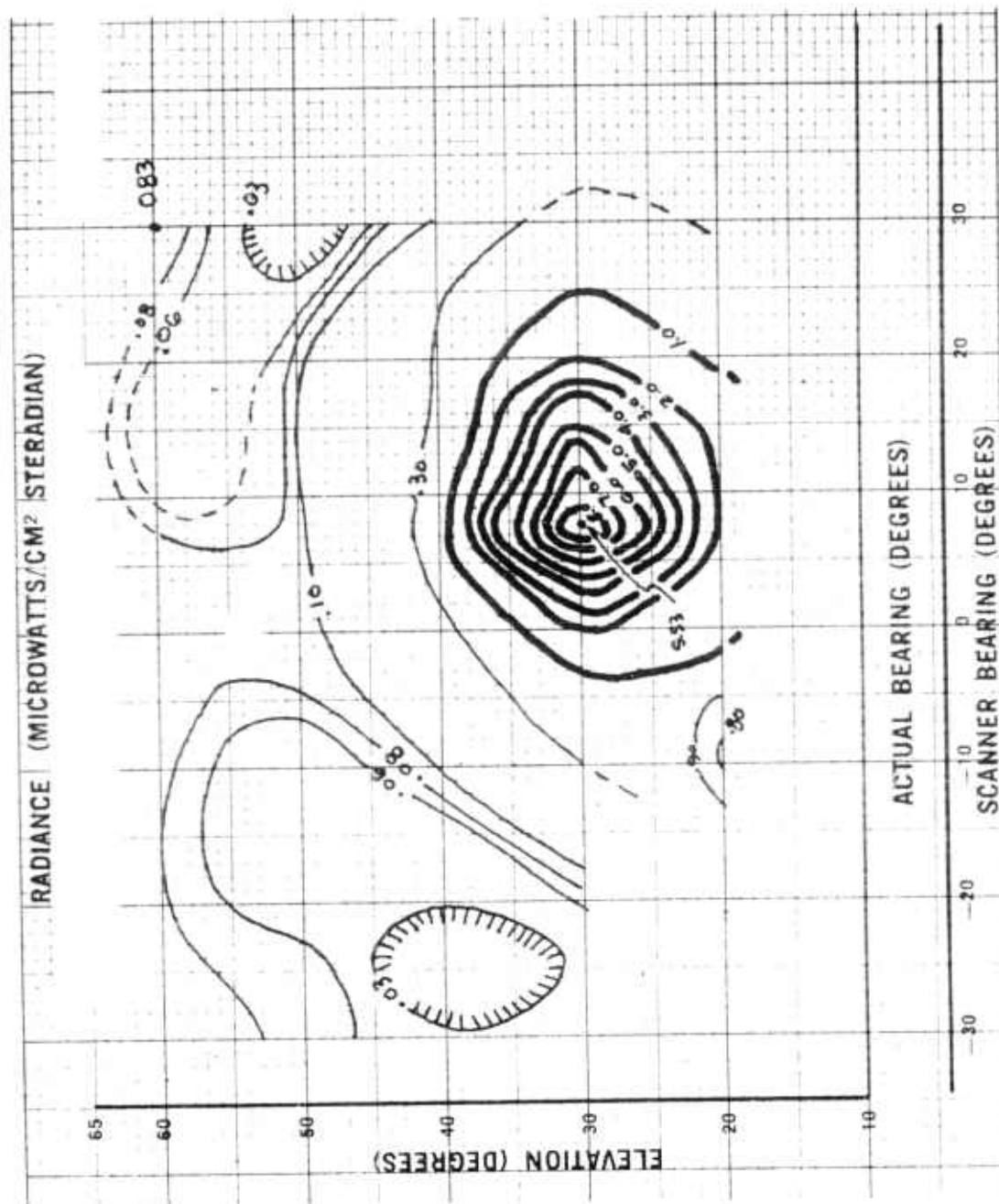
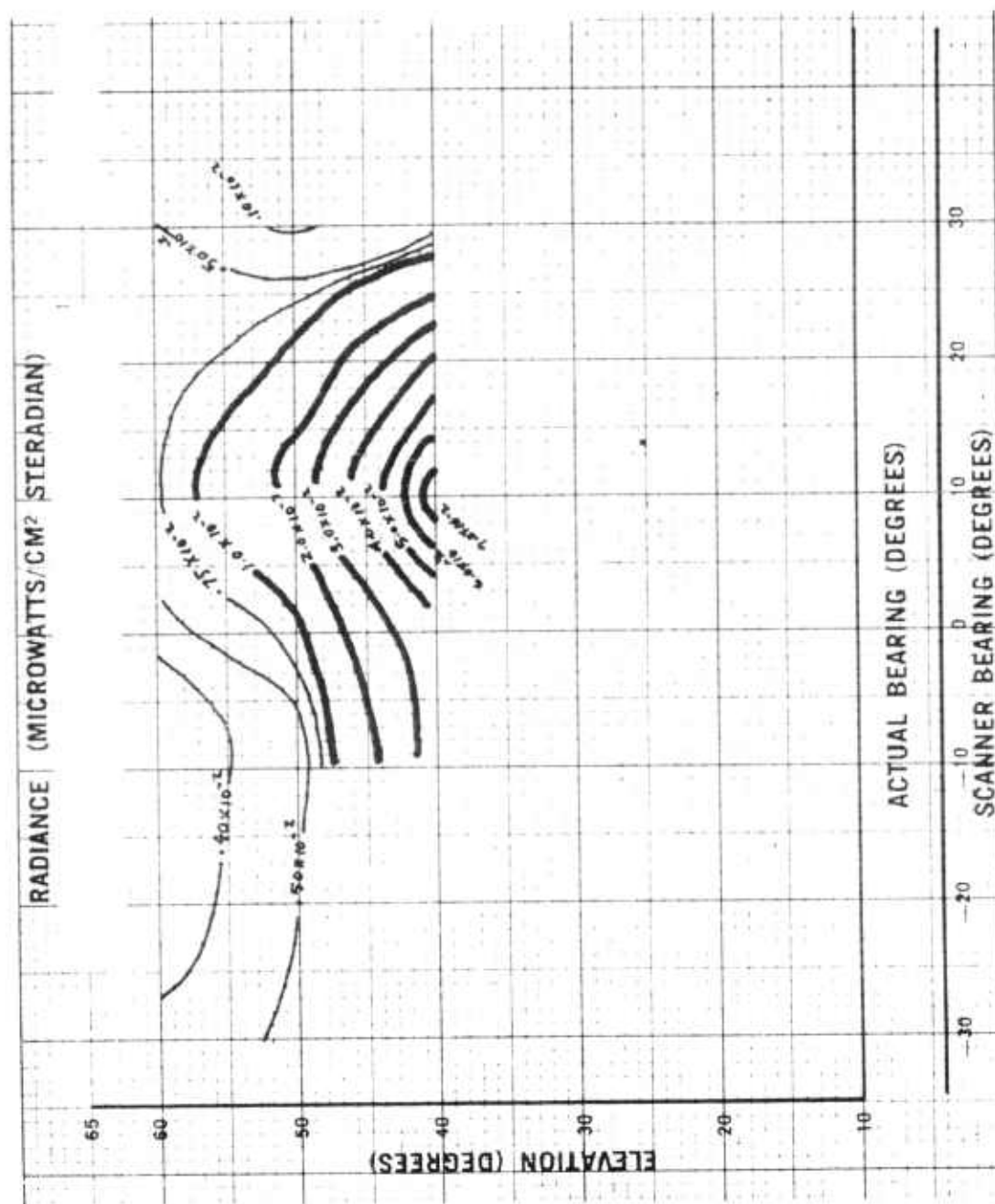


Figure 3.225 Sky radiance, Kettle I, Chuck Mate, 0.521 to 0.567 microns, H+7 seconds.



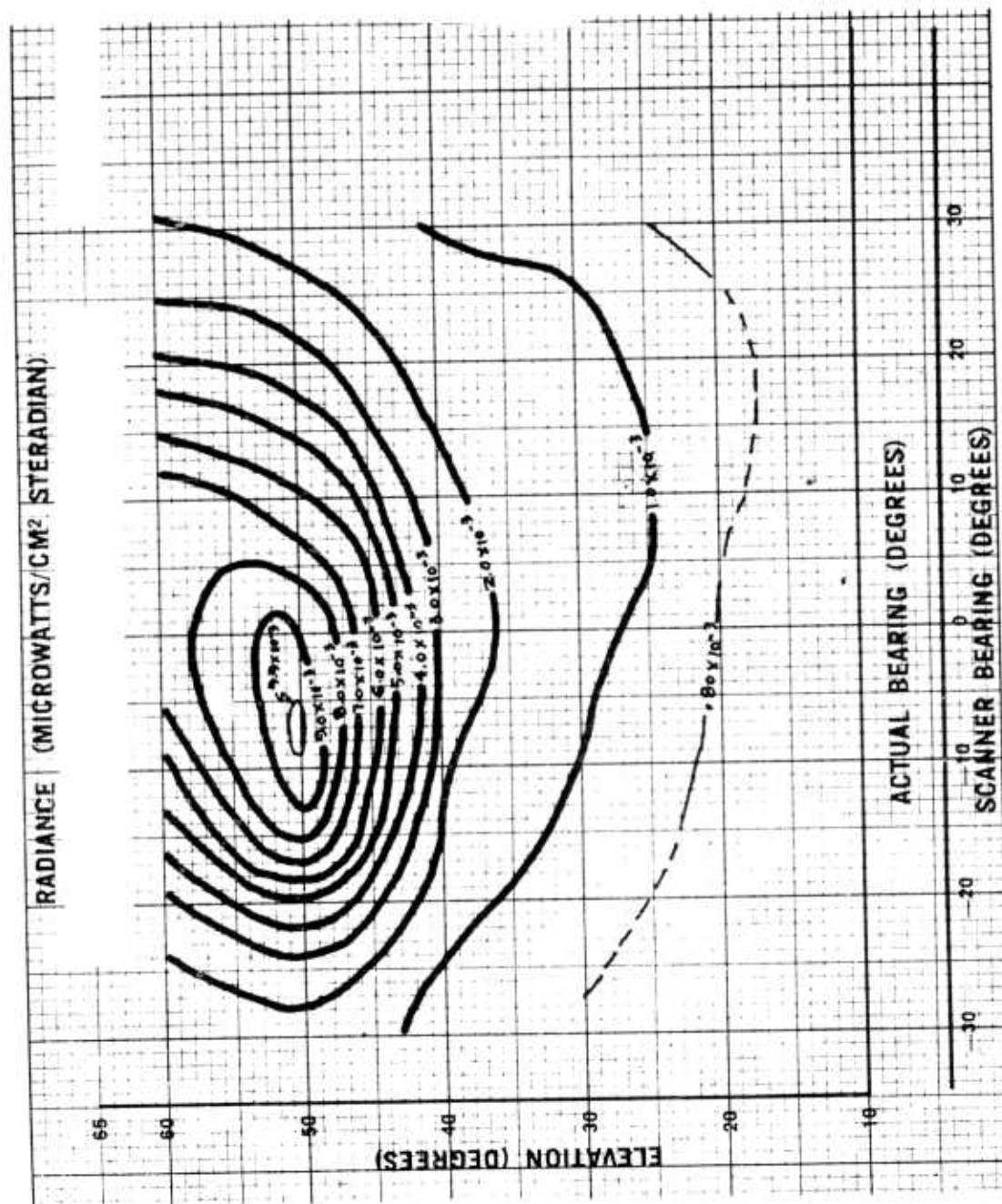


Figure 3.227 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H+142 seconds.

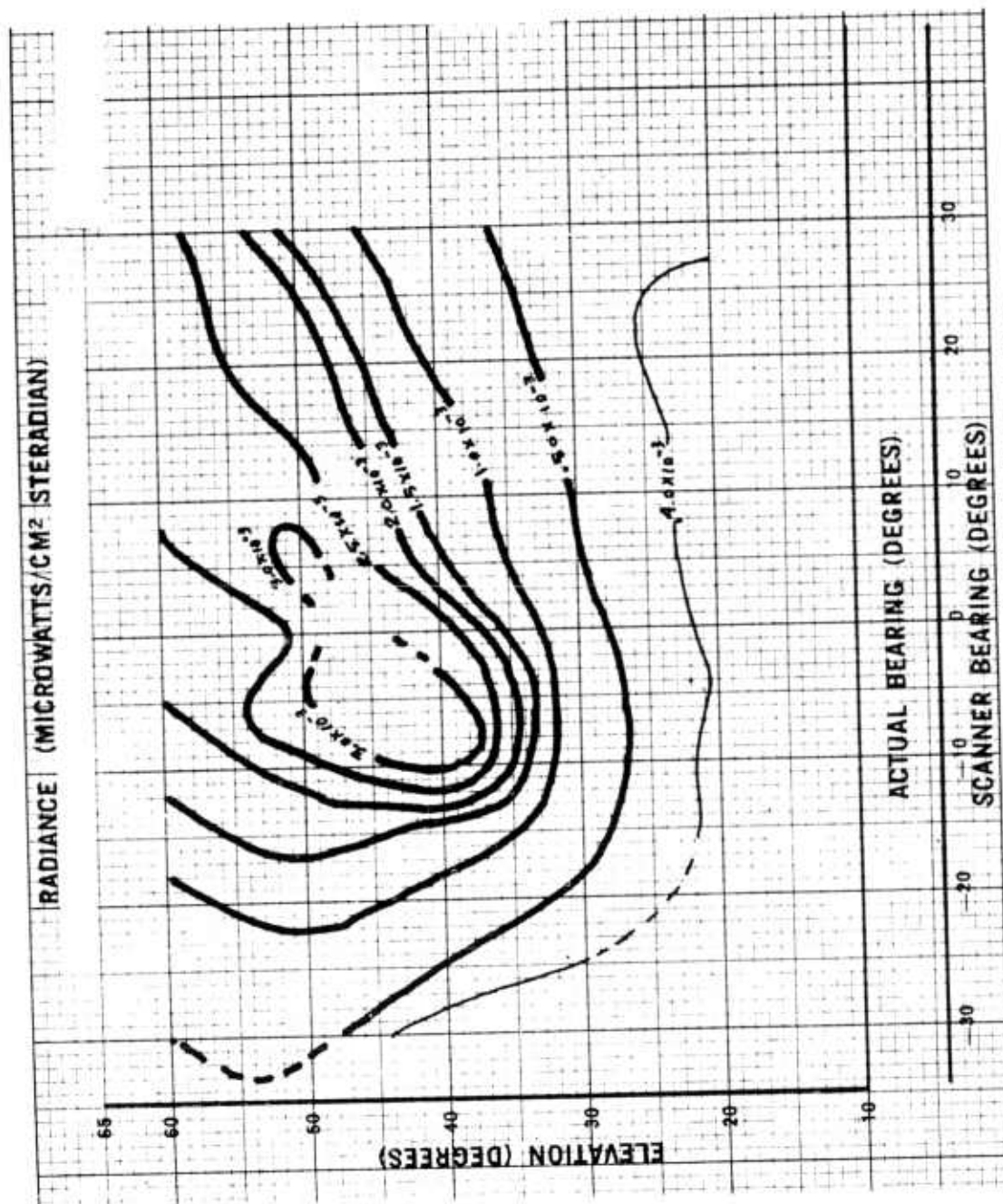


Figure 3.228 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H+210 seconds.



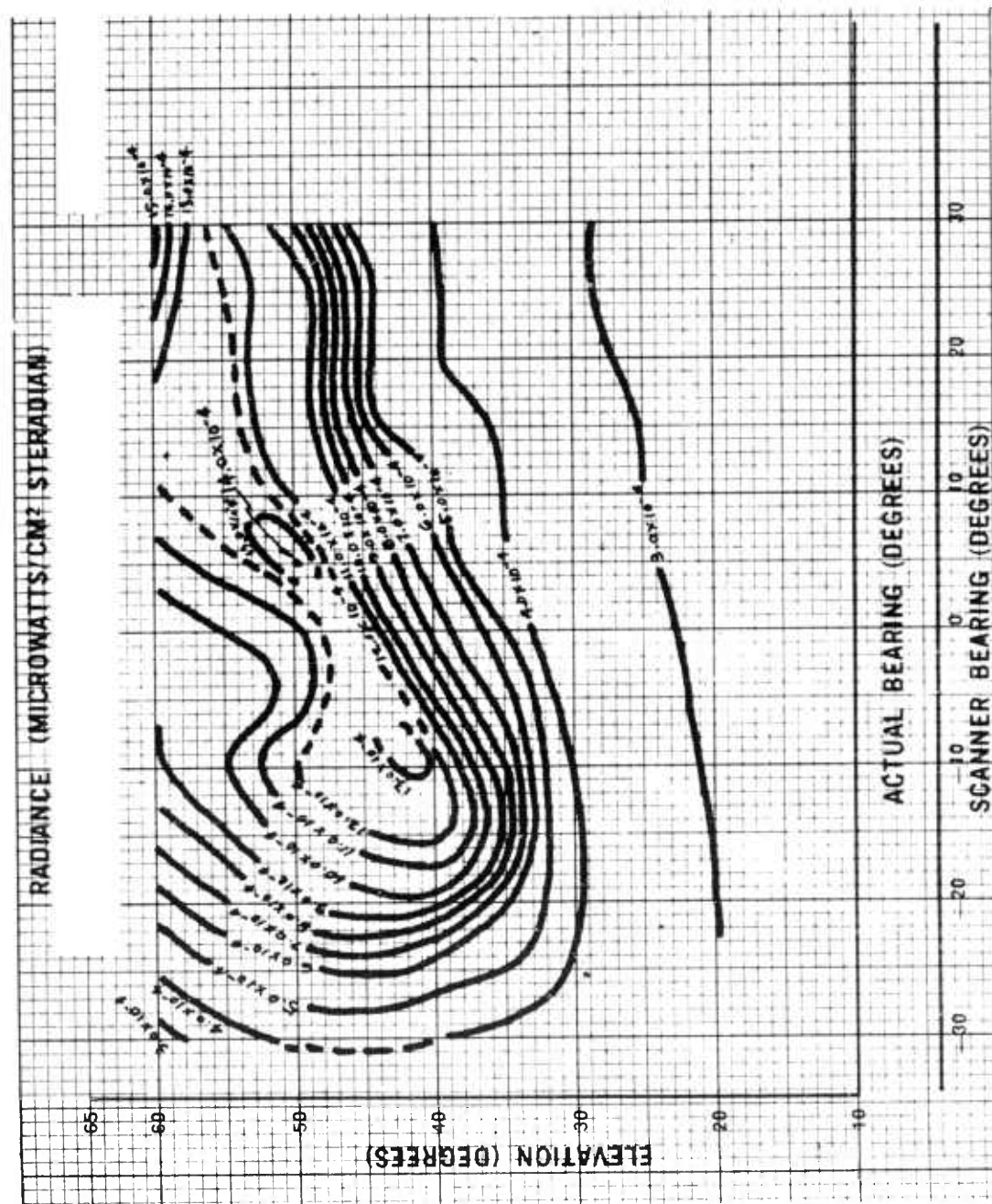


Figure 3.229 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 278 seconds.

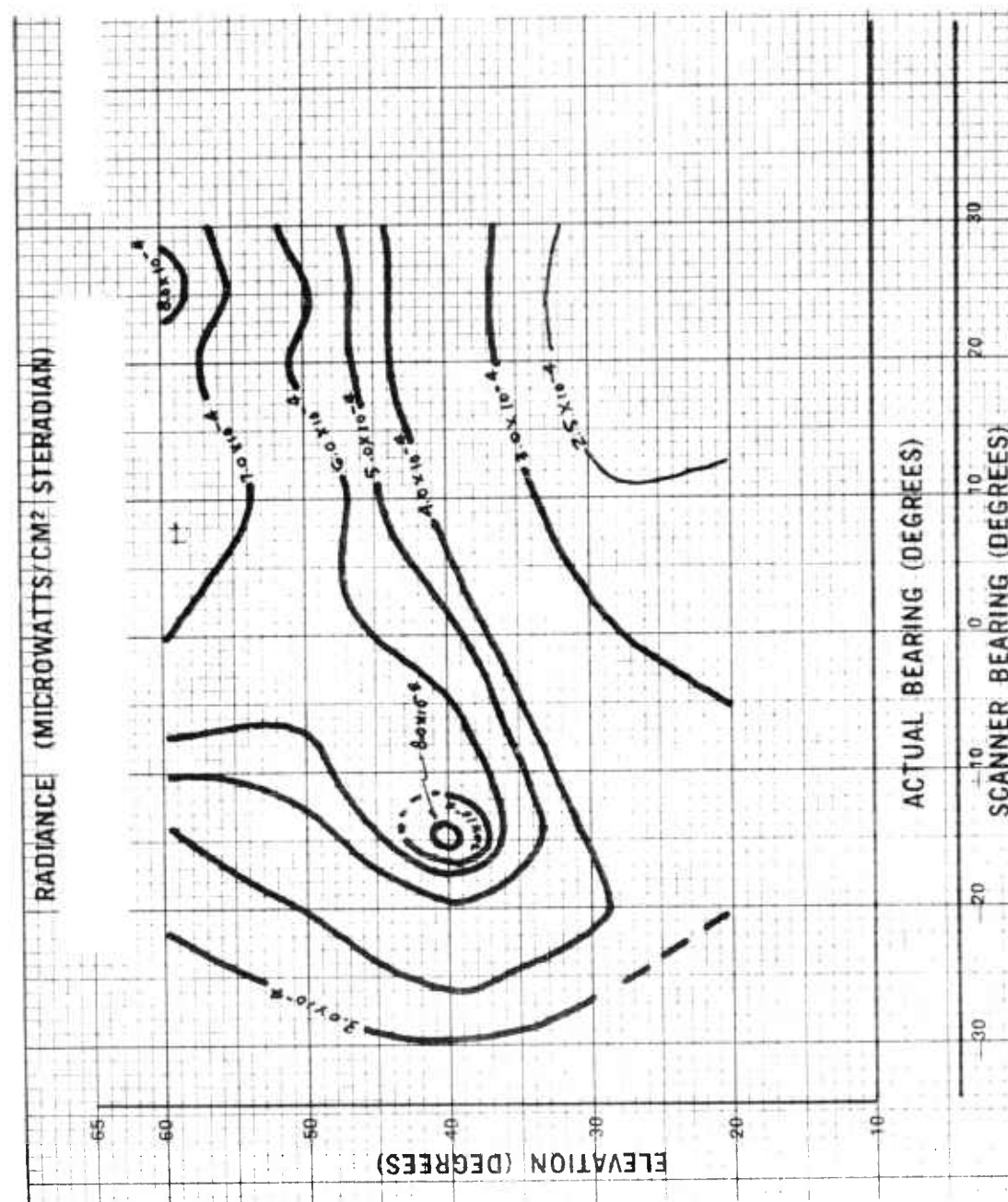
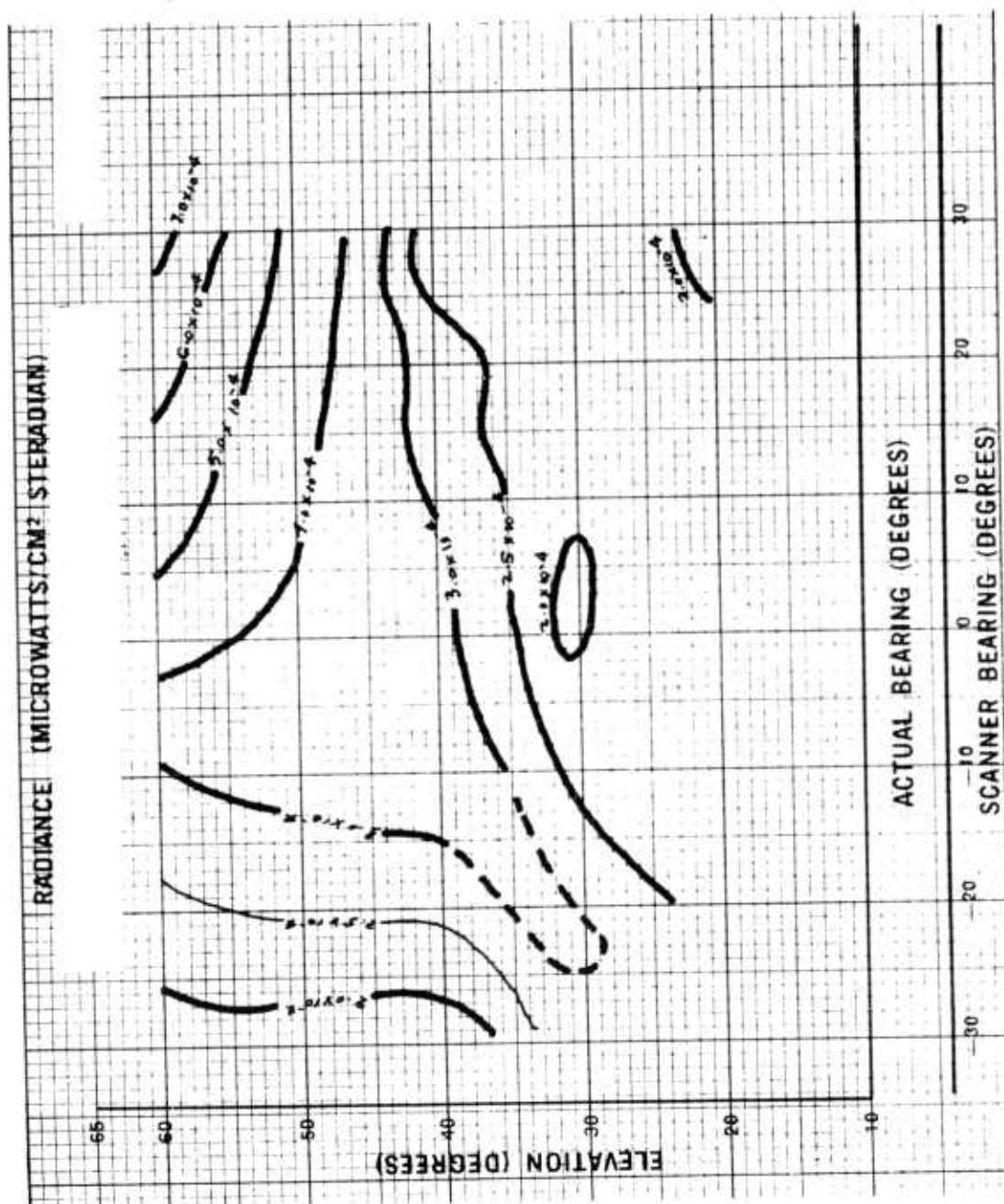


Figure 3.230 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 345 seconds.





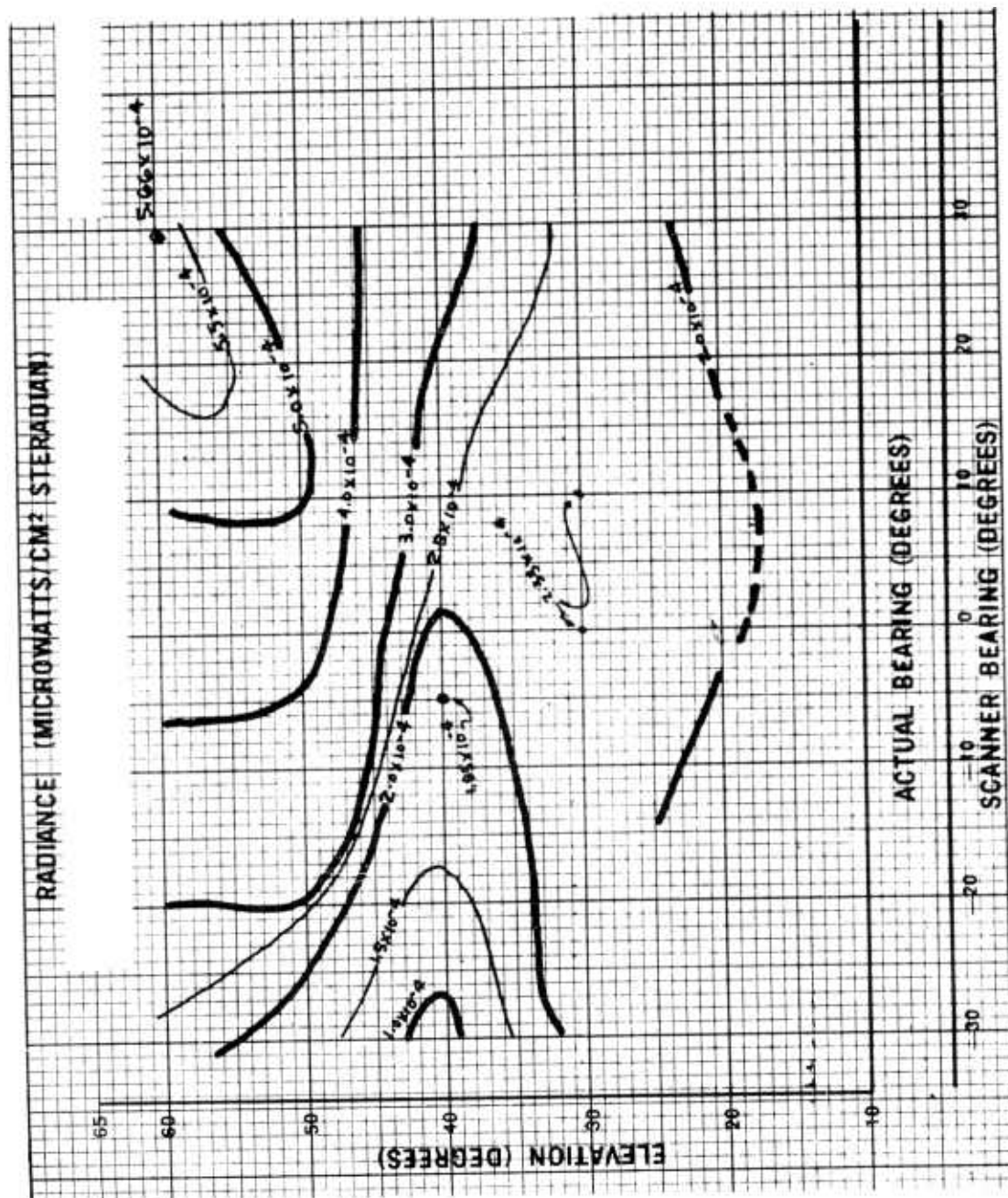


Figure 3.232 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 481 seconds.

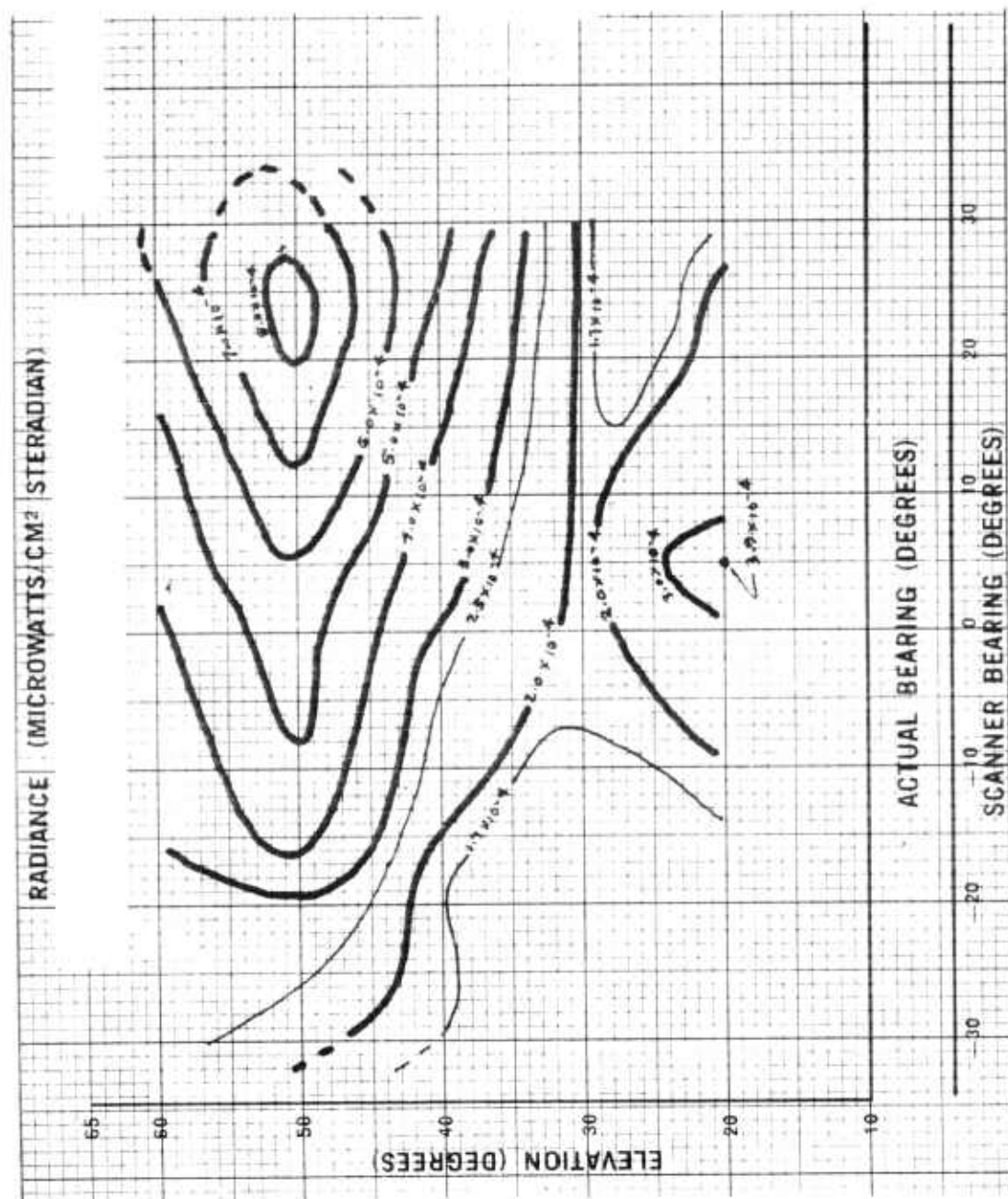


Figure 3.233 Sky radiance, Kettle 1, Check Mate, 0.521 to 0.567 microns, H+548 seconds.

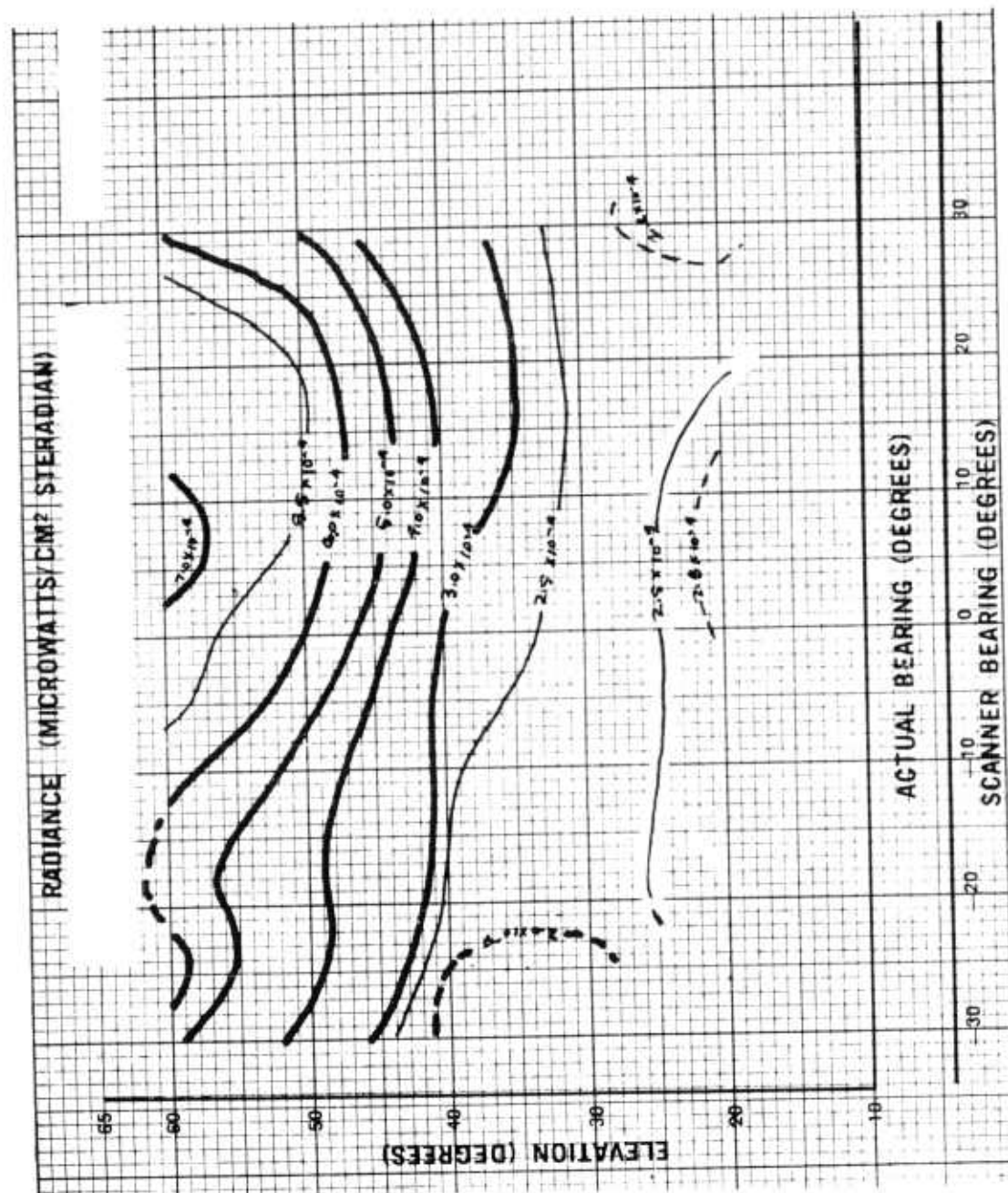


Figure 3.234 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 616 seconds.

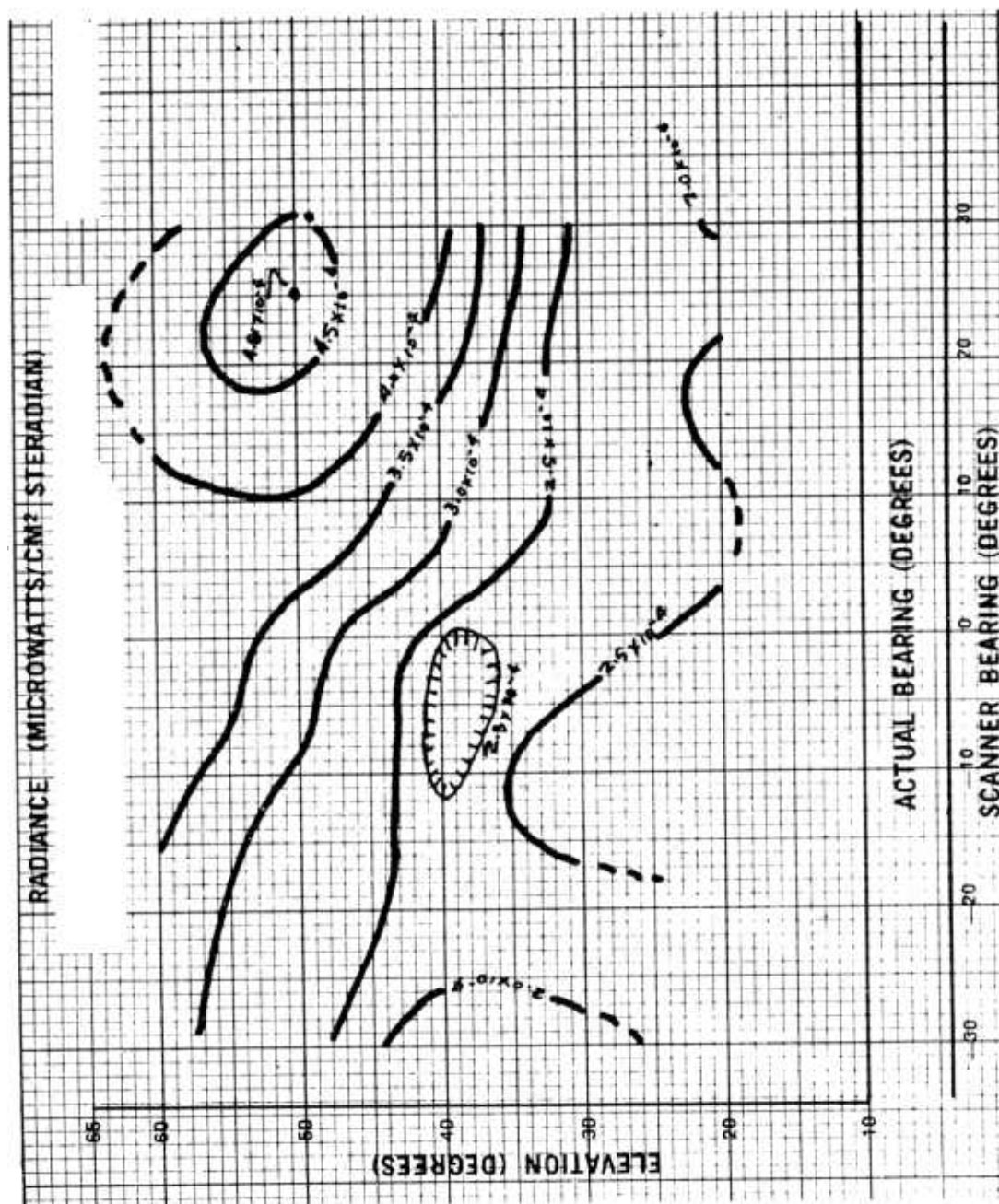
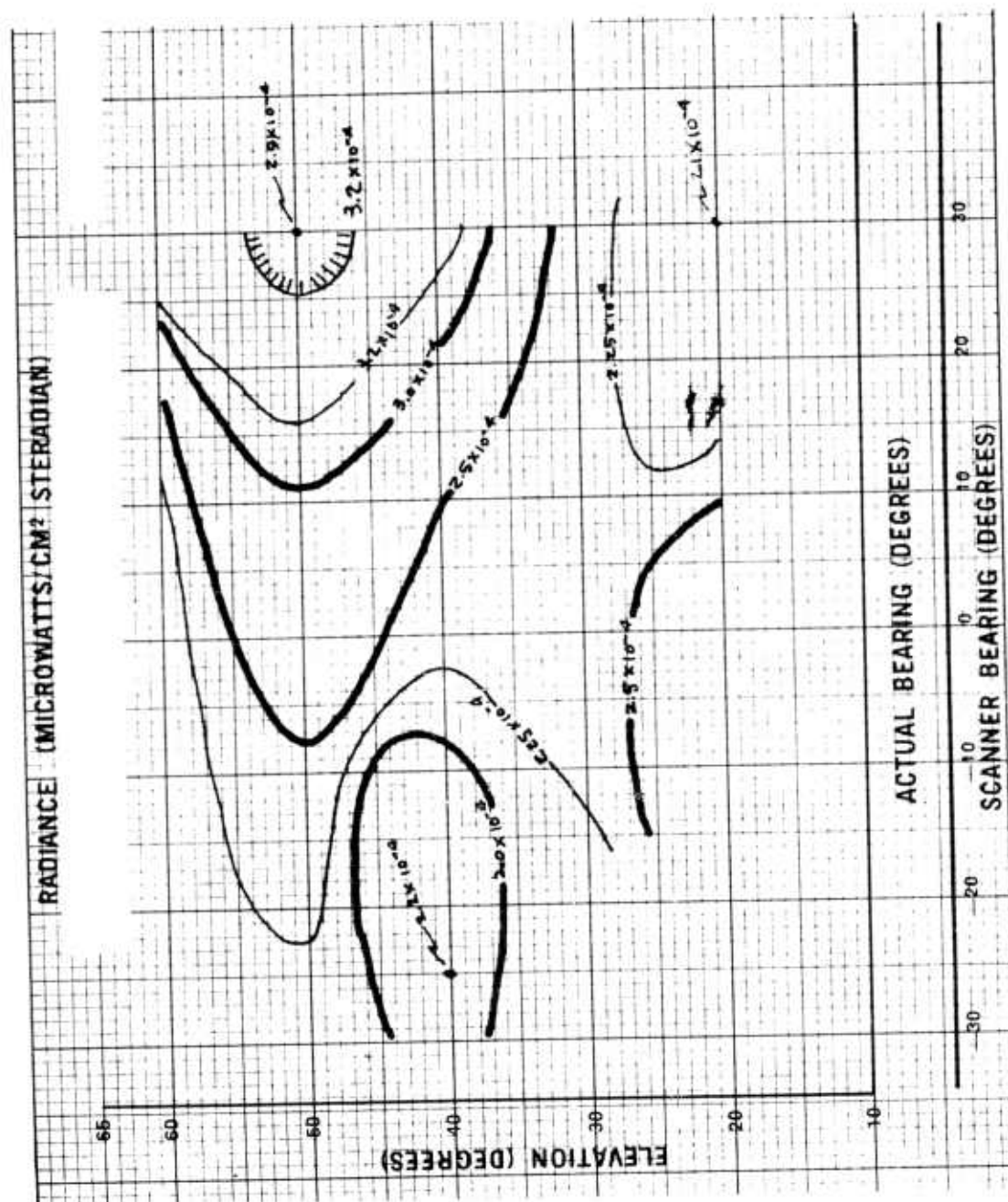


Figure 3.235 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H+684 seconds.





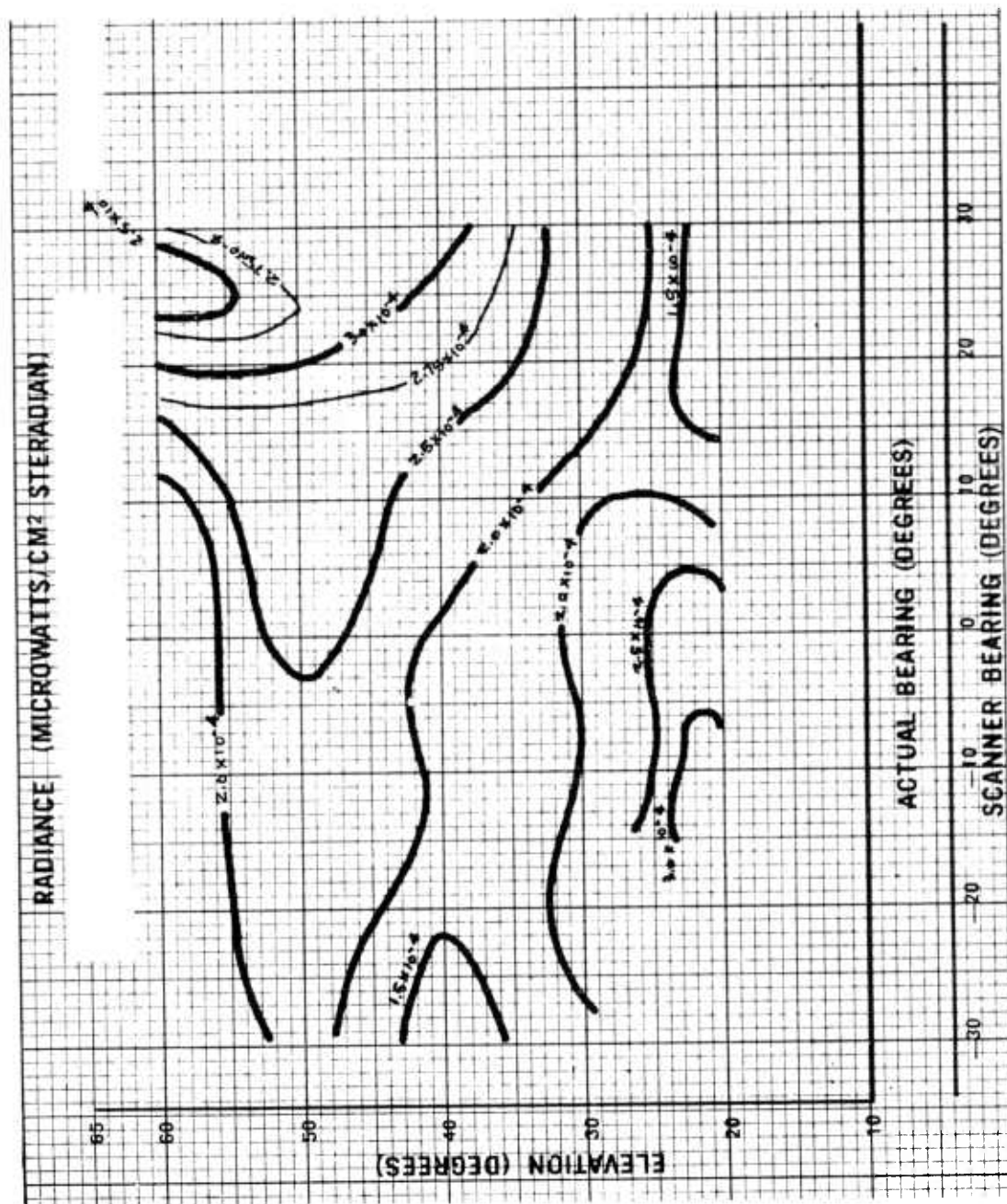


Figure 3.237 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 819 seconds.

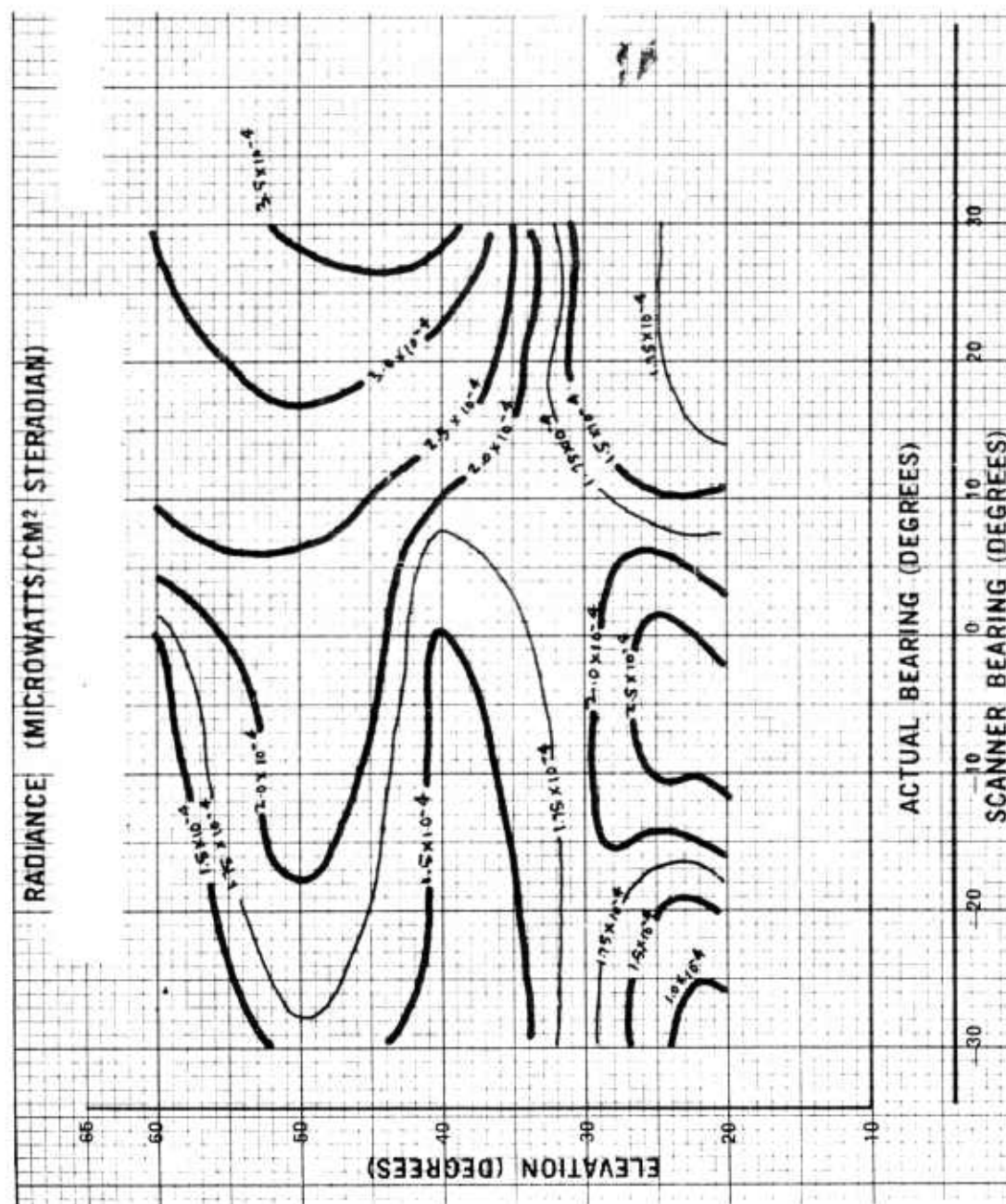


Figure 3.238 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 887 seconds.



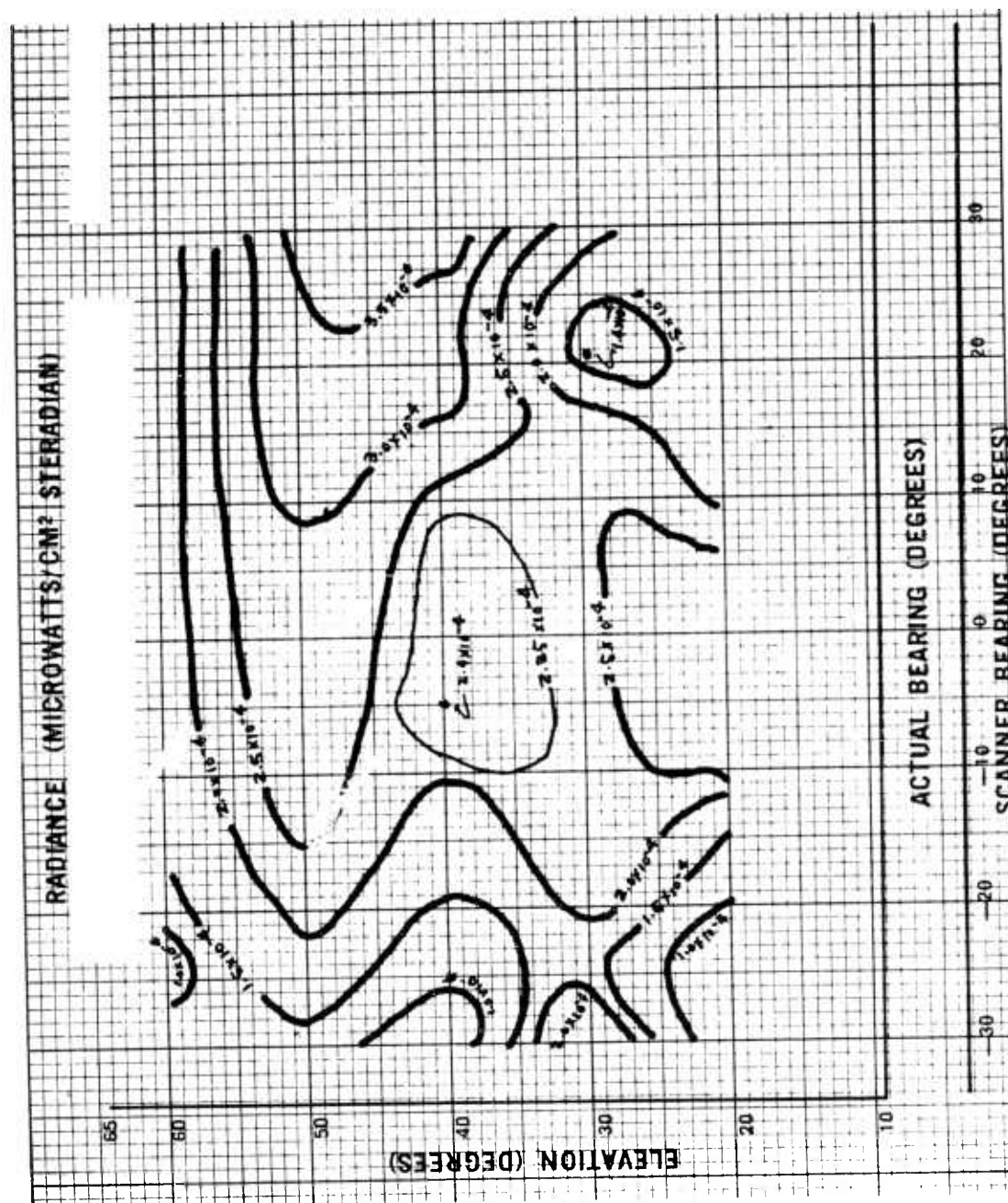


Figure 3.239 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 954 seconds.



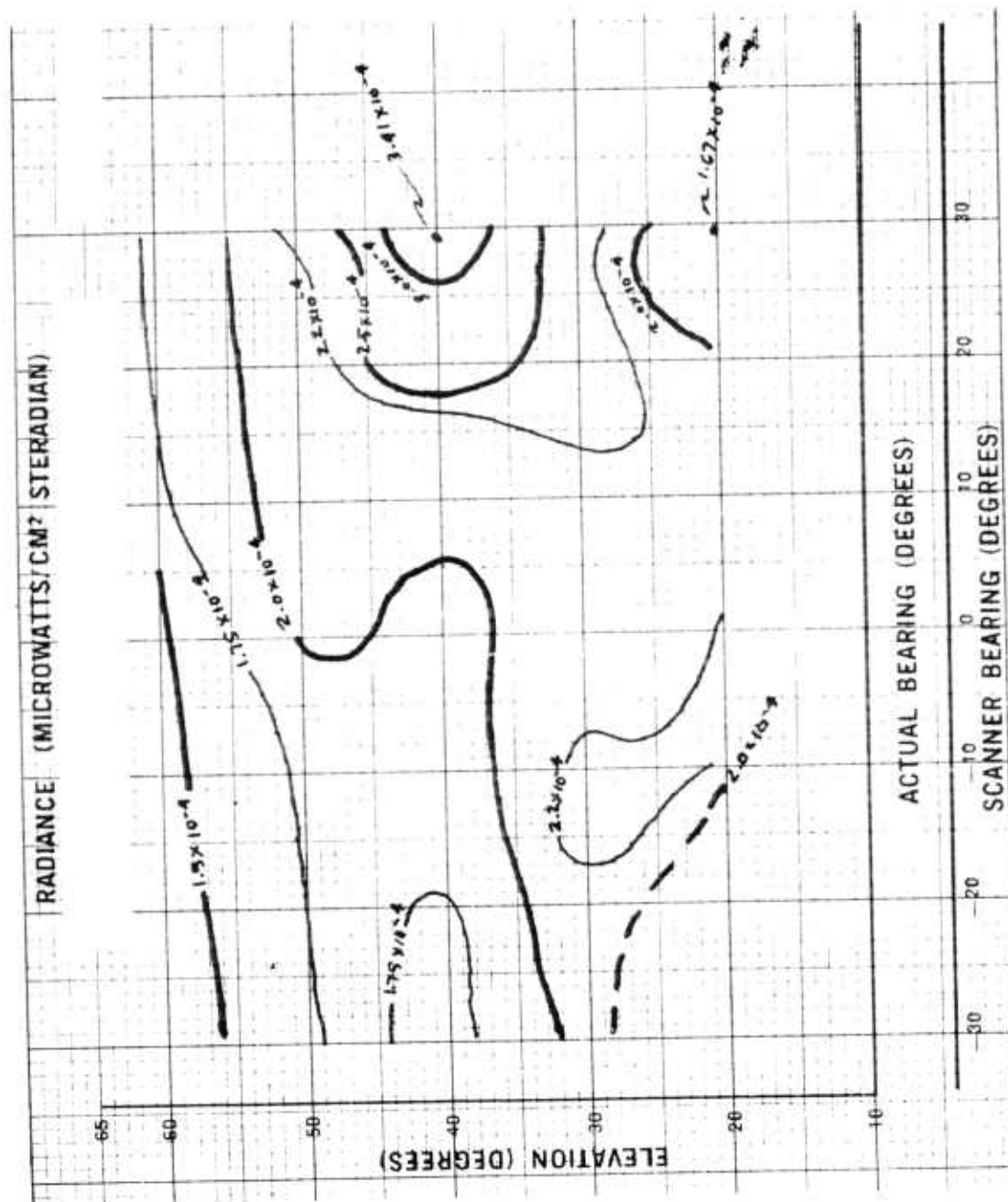


Figure 3.241 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 1.293 seconds.

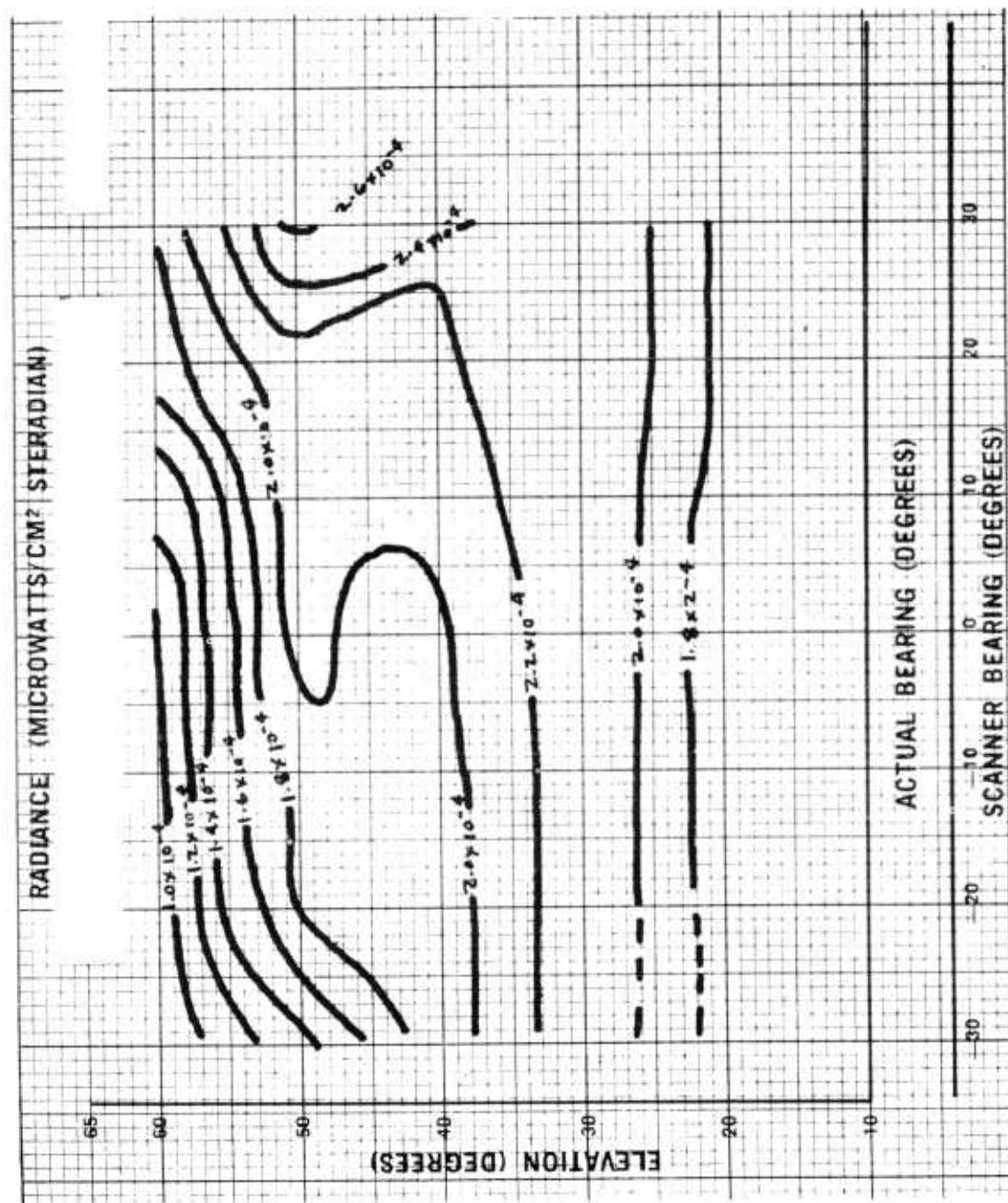


Figure 3.242 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H+2,241 seconds.

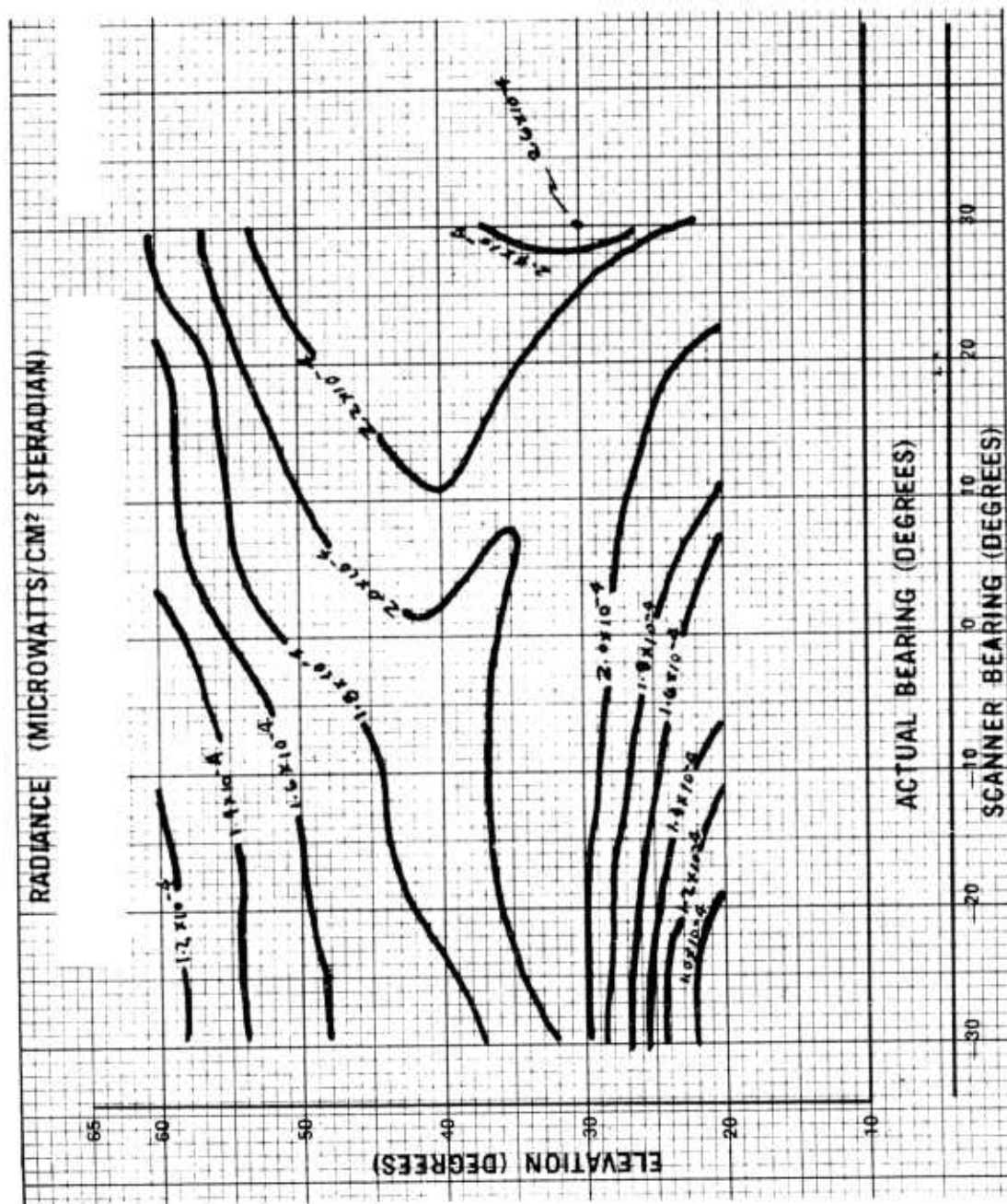


Figure 3.243 Sky radiance, Kettle I, Check Mate, 0.521 to 0.567 microns, H + 2,784 seconds.



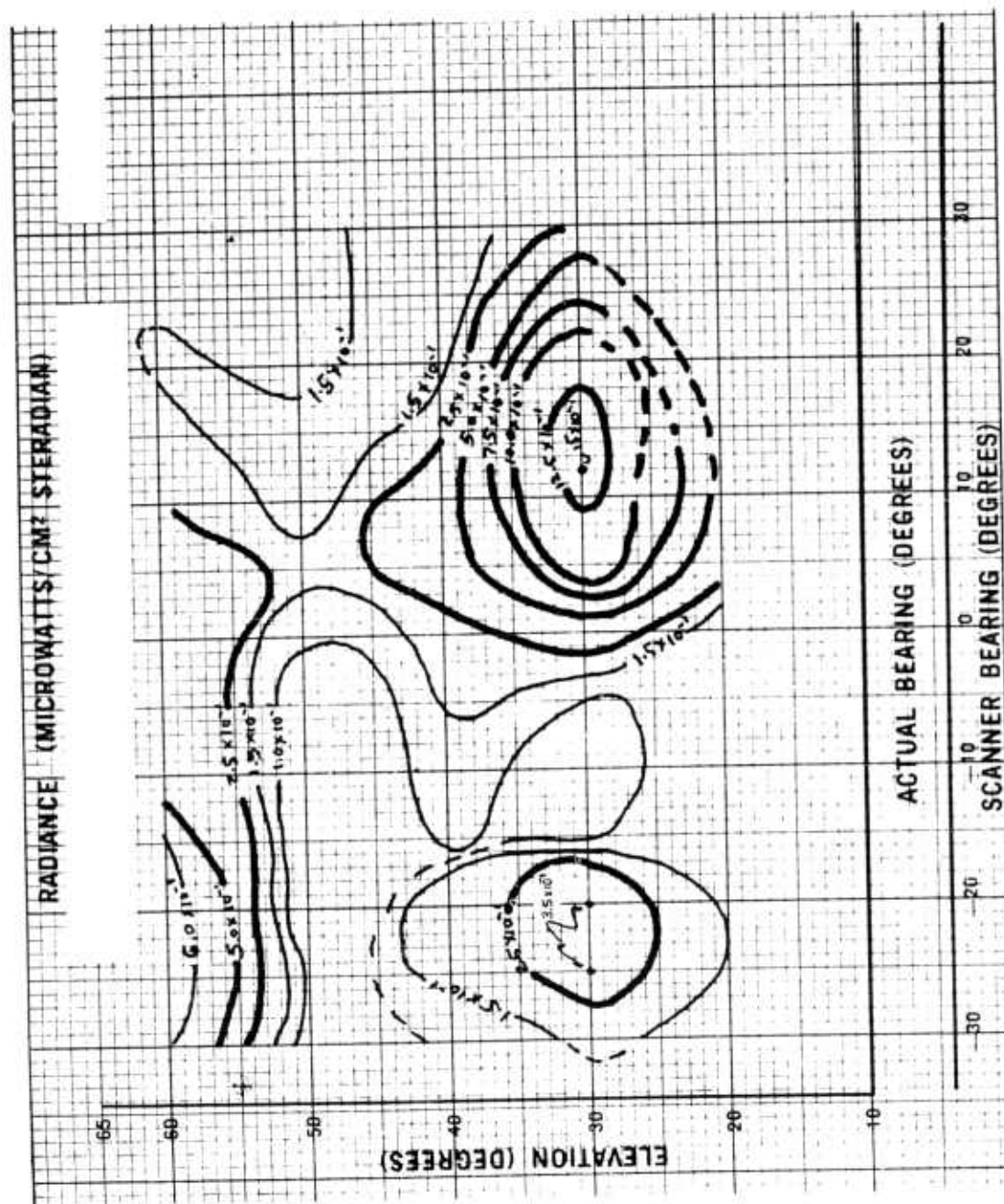


Figure 3.244 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H+18 seconds.



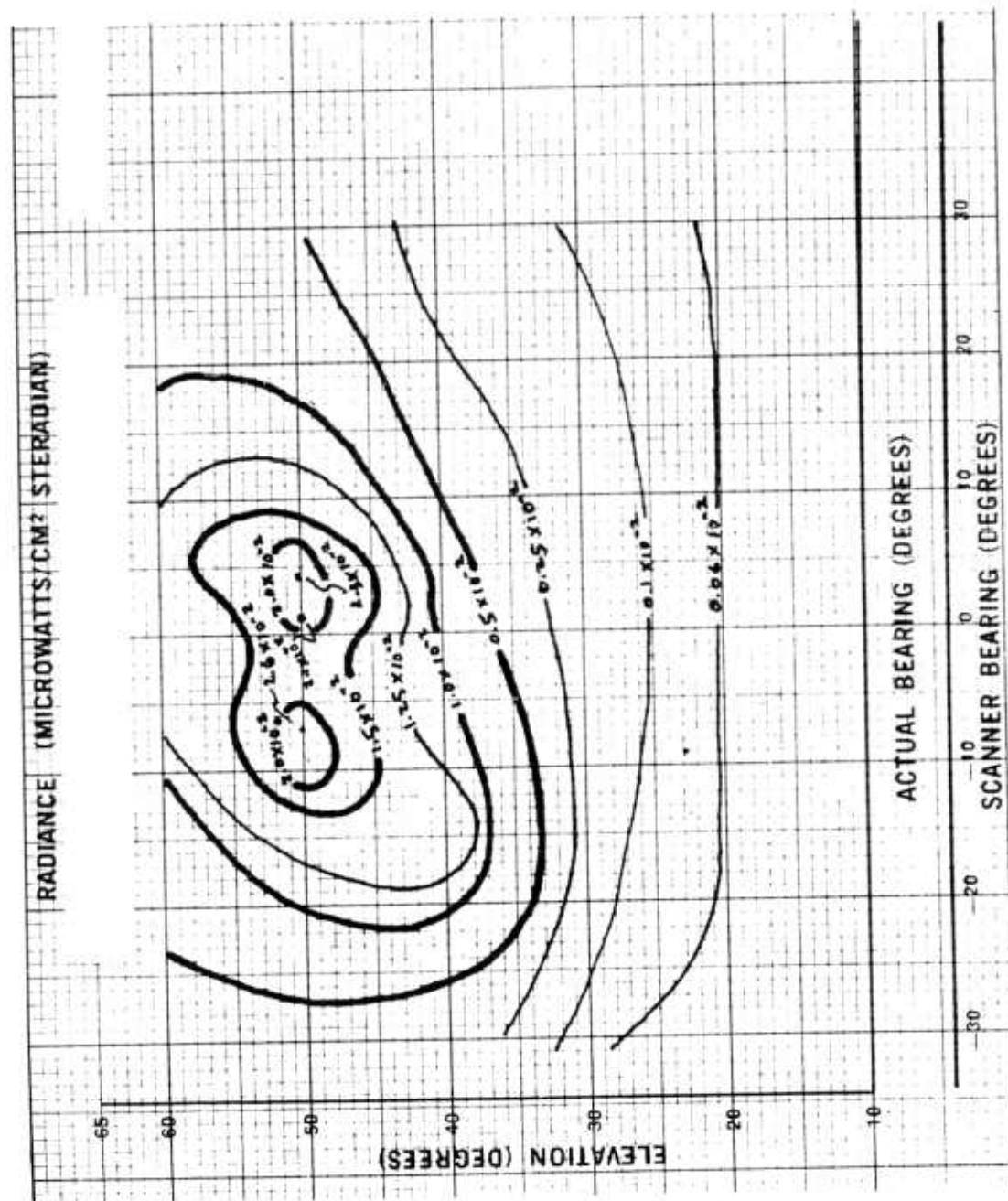
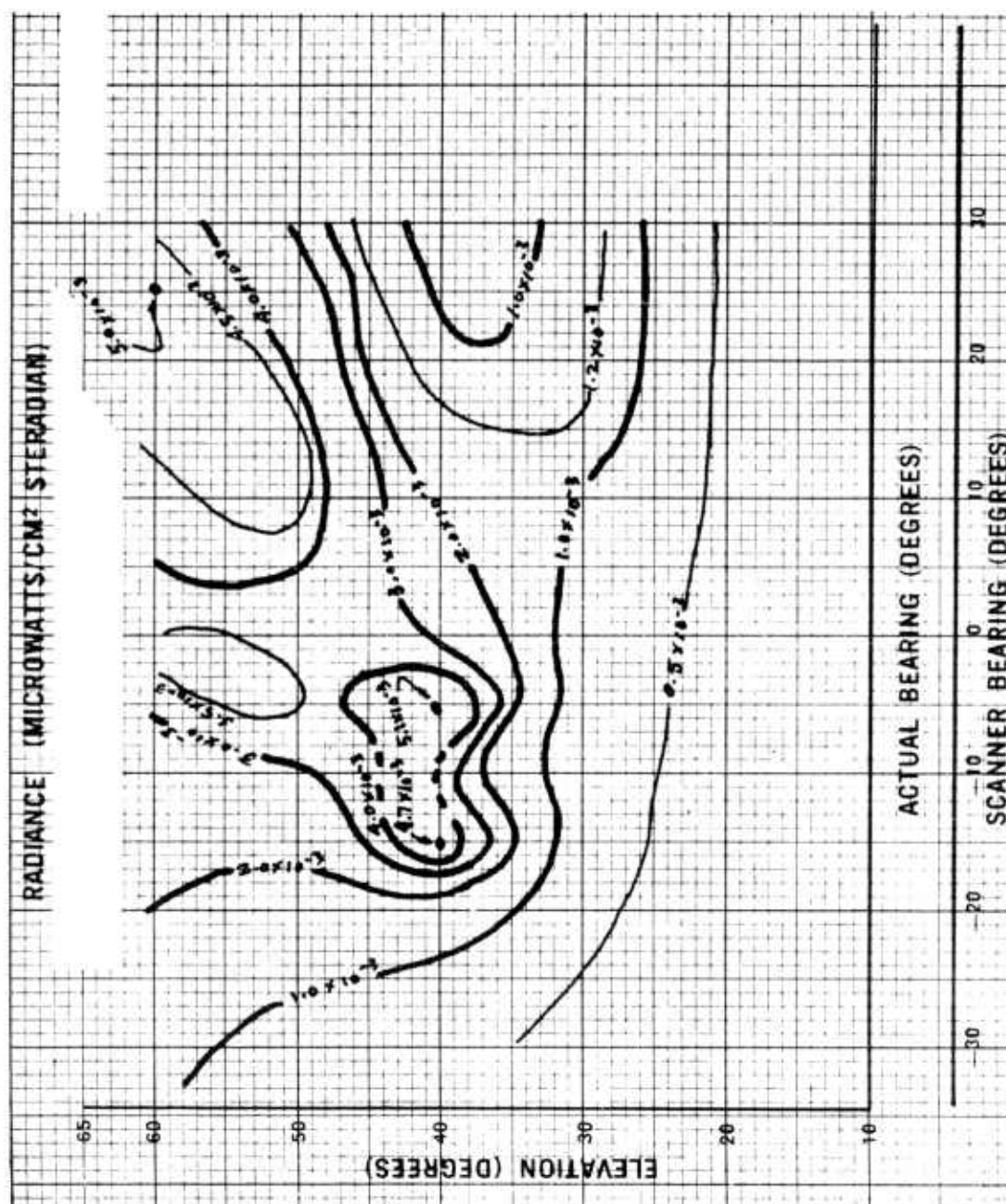
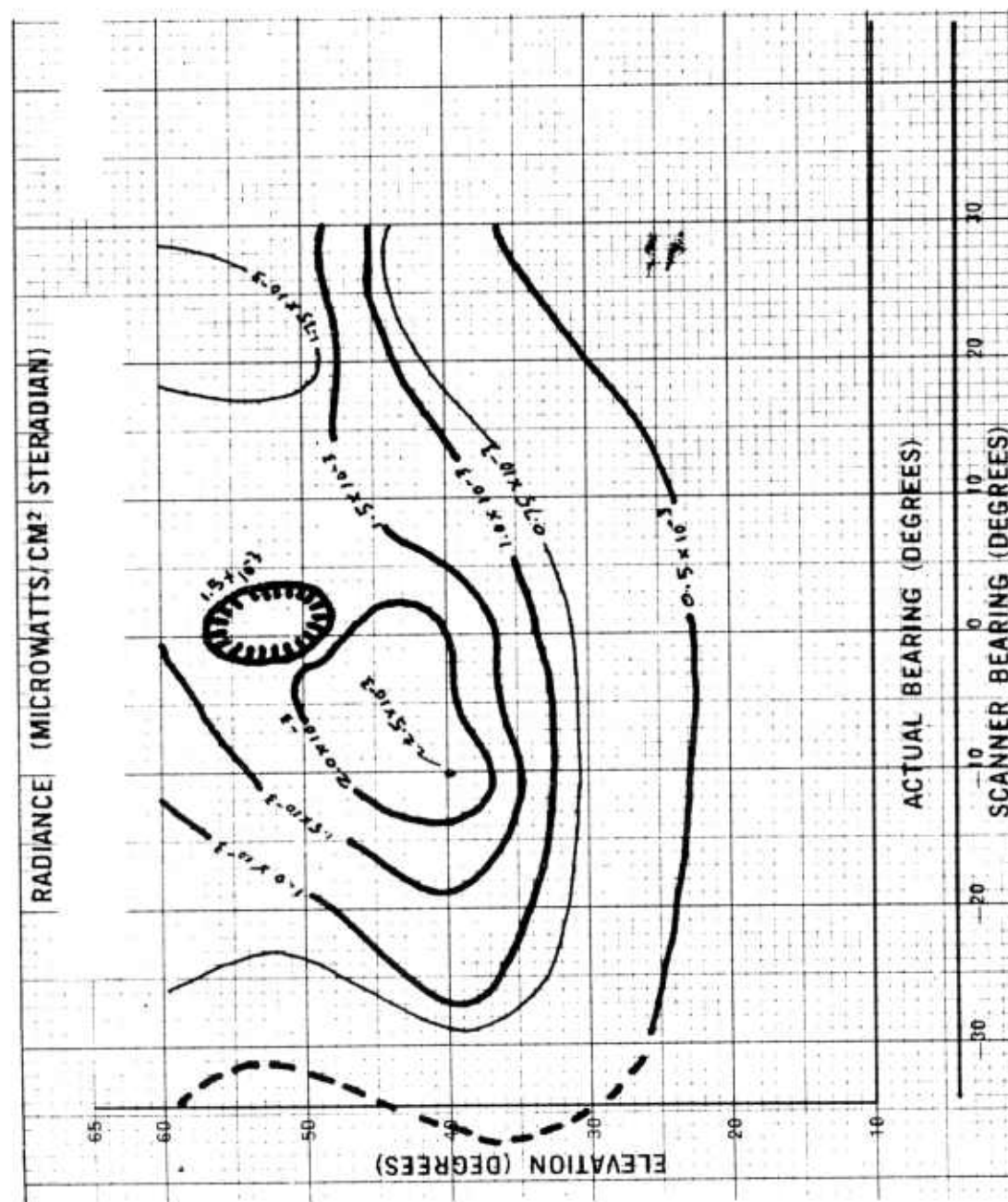


Figure 3.246 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H + 153 seconds.







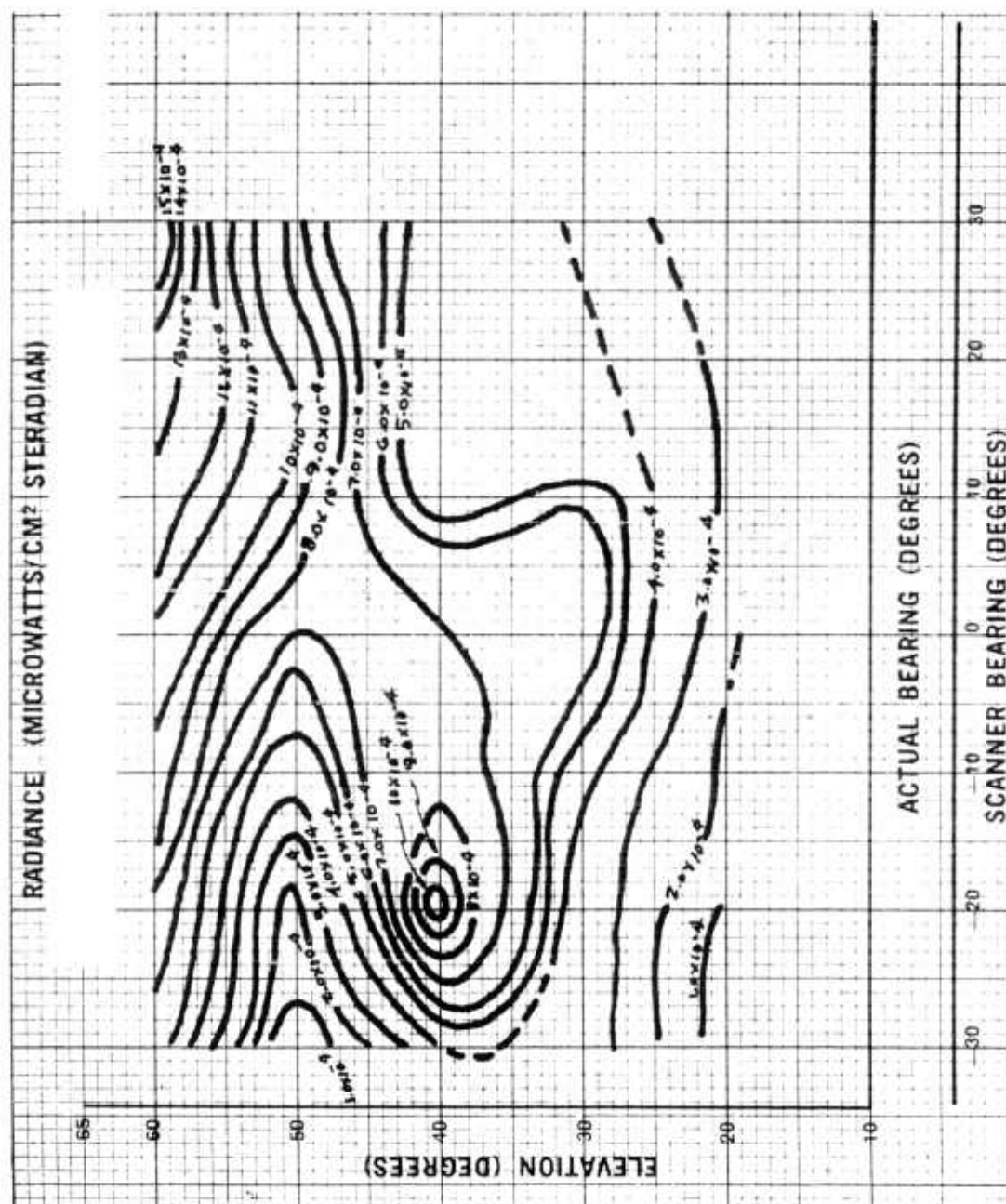


Figure 3.249 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H + 356 seconds.

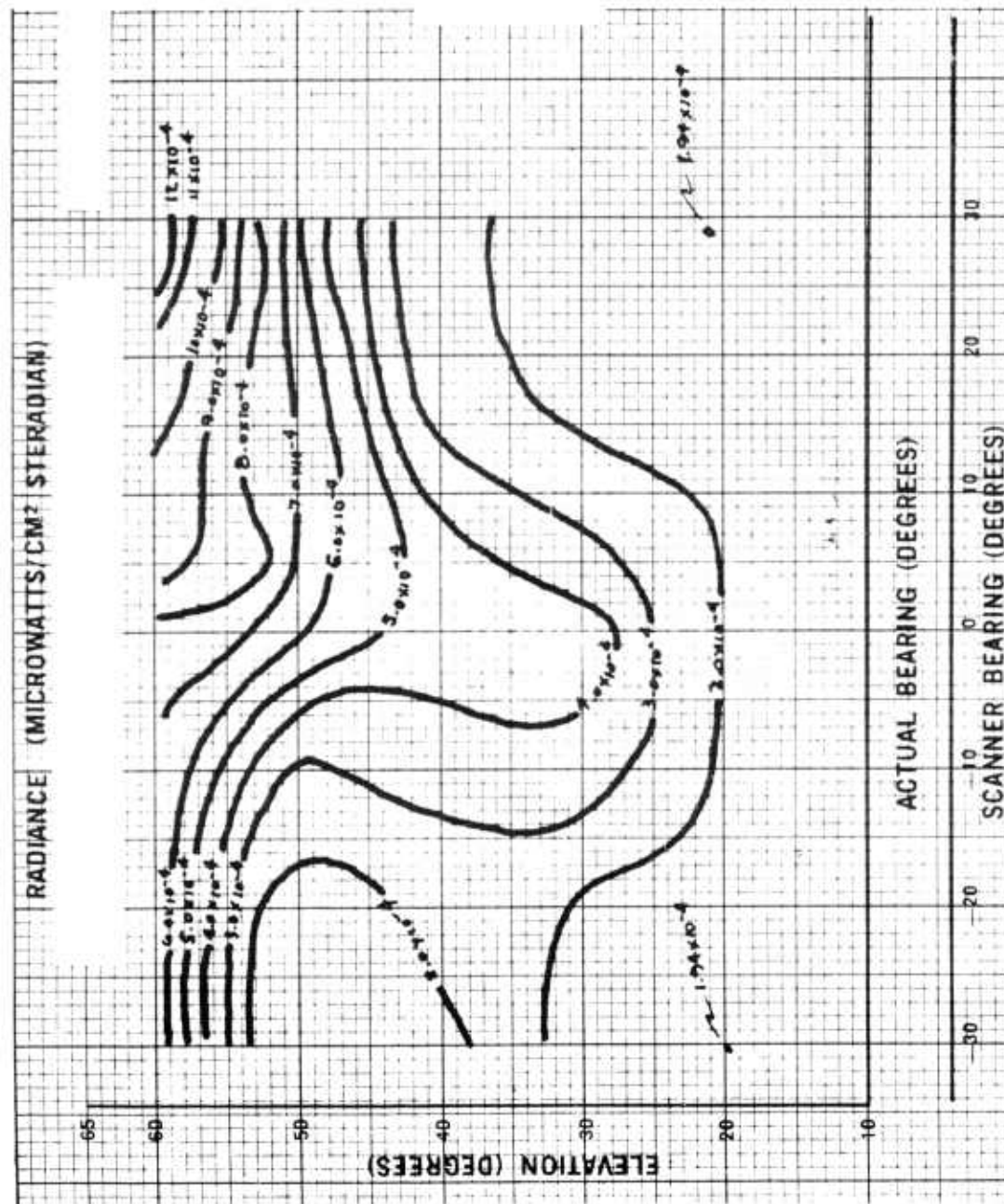


Figure 3.250 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H + 492 seconds.

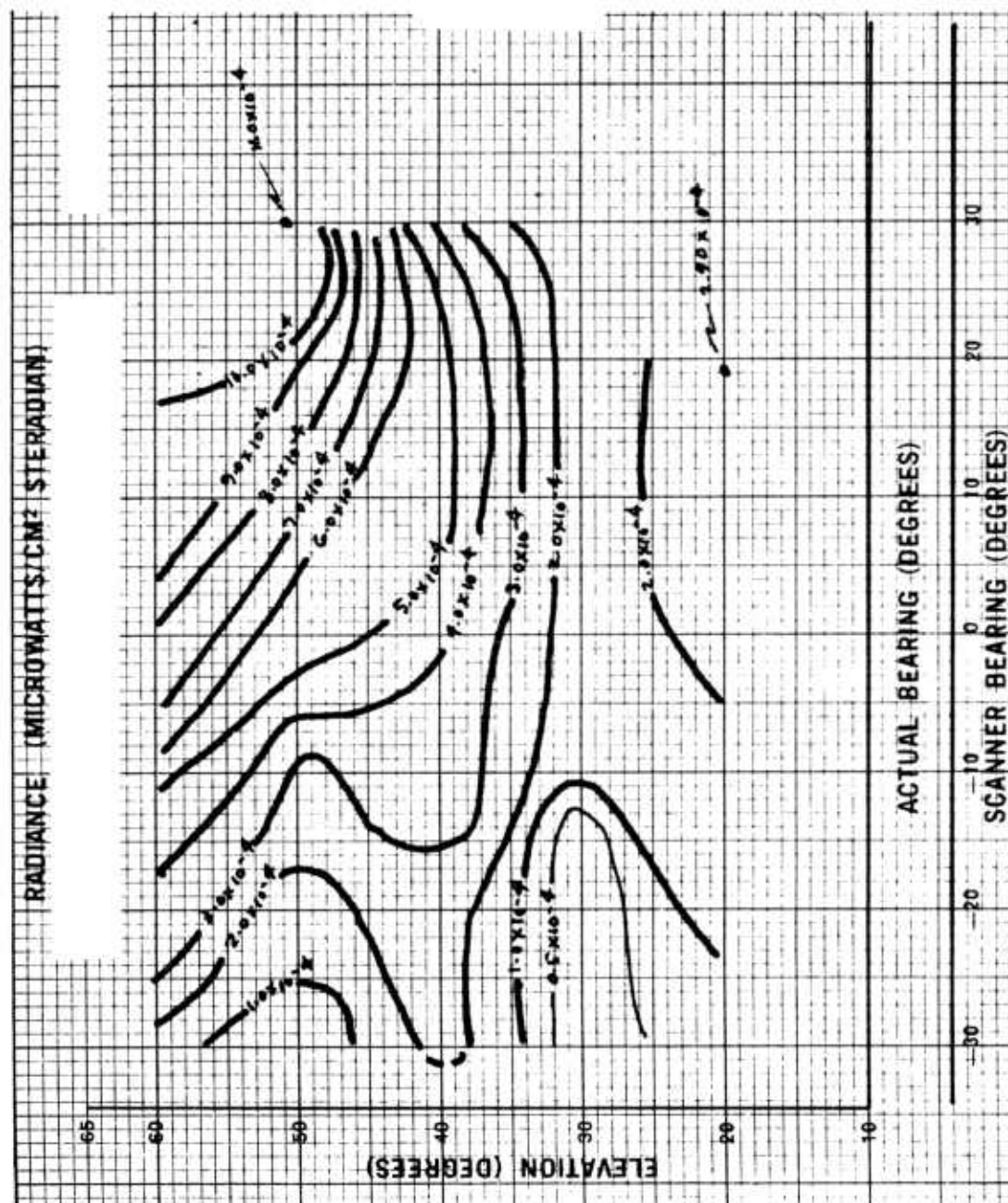


Figure 3.251 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H + 559 seconds.



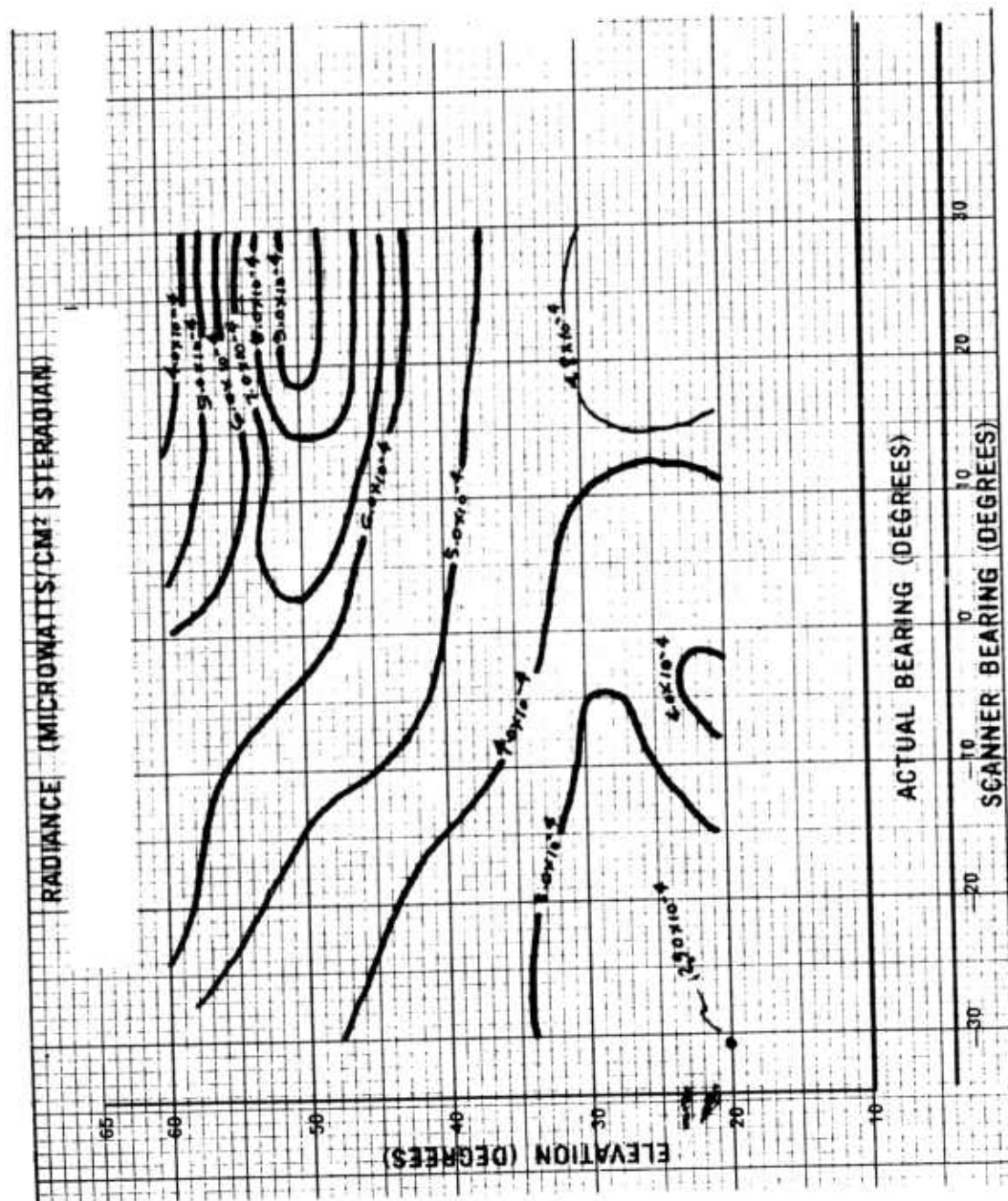


Figure 3.252 Sky radiance, Kettle I, Check Mate, 0.590 to 0.613 microns, H + 695 seconds.

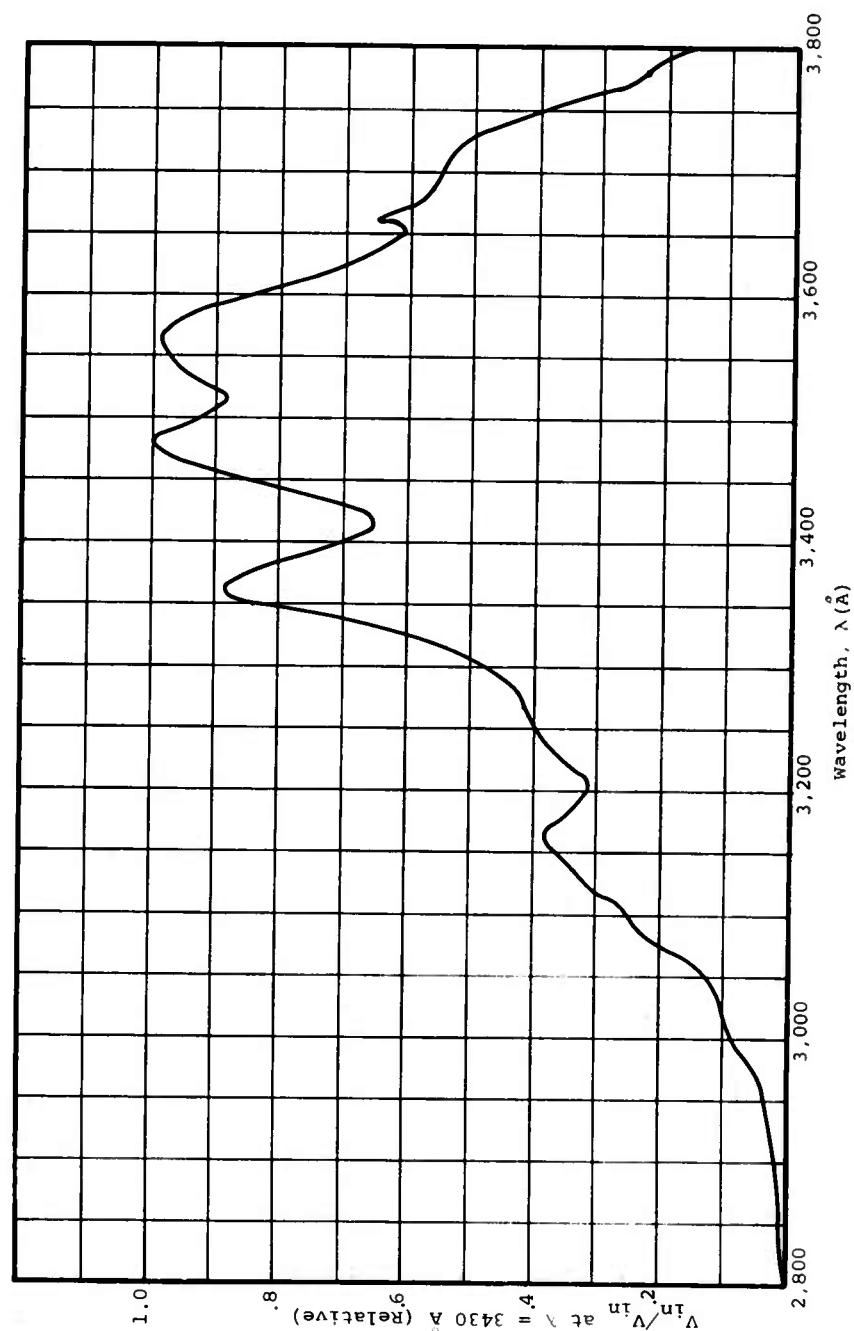


Figure 3.253 Normalized UV spectrogram at H + 8 seconds,  
Kettle I, Check Mate.

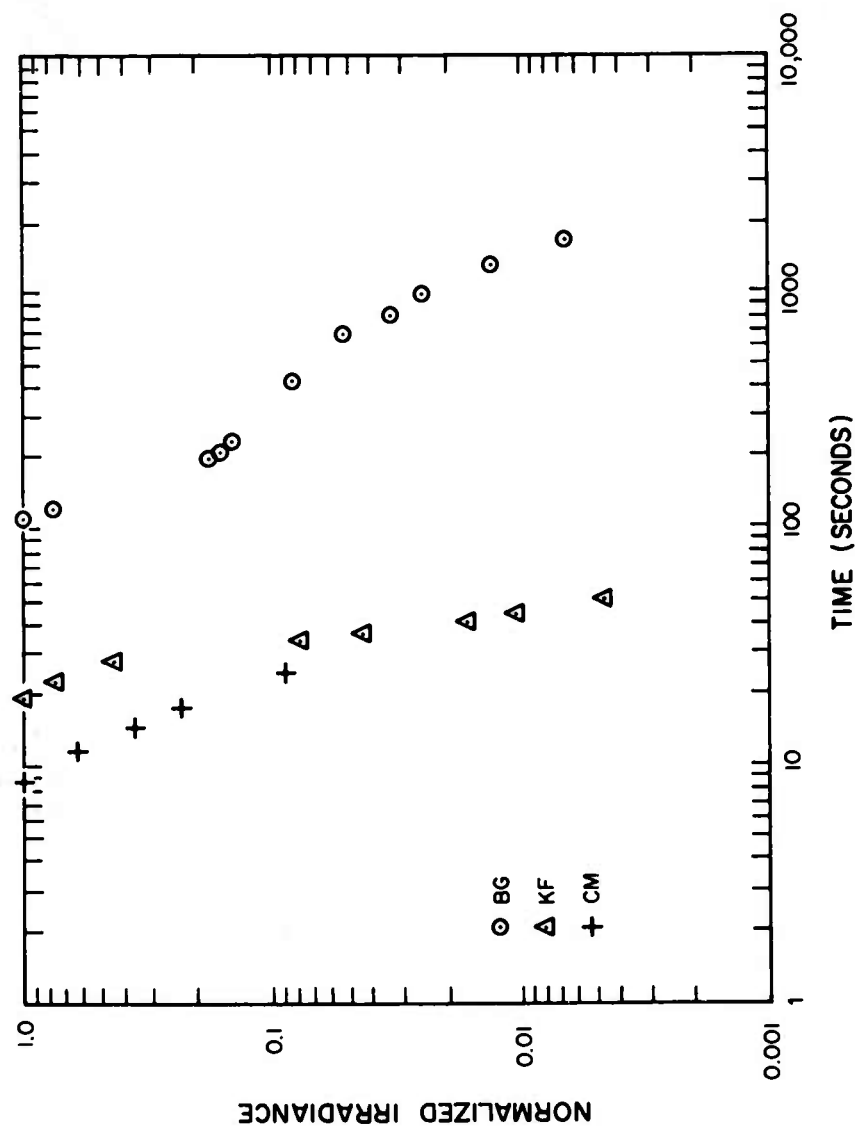


Figure 3.254 Decay of 3,560-Angstrom band, Blue Gill Triple Prime, and King Fish.



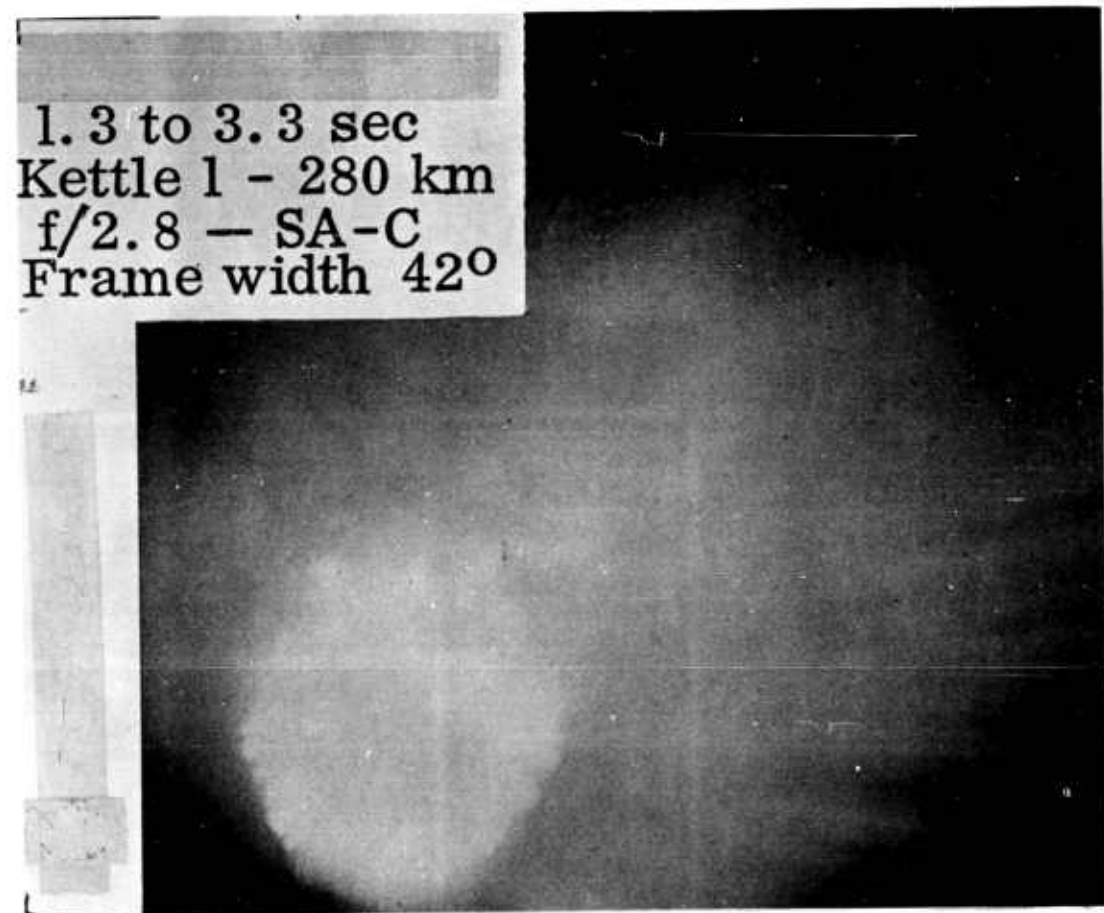


Figure 3.255 70-mm camera photo from Kettle I, Check Mate,  
1.3 to 3.3 seconds.

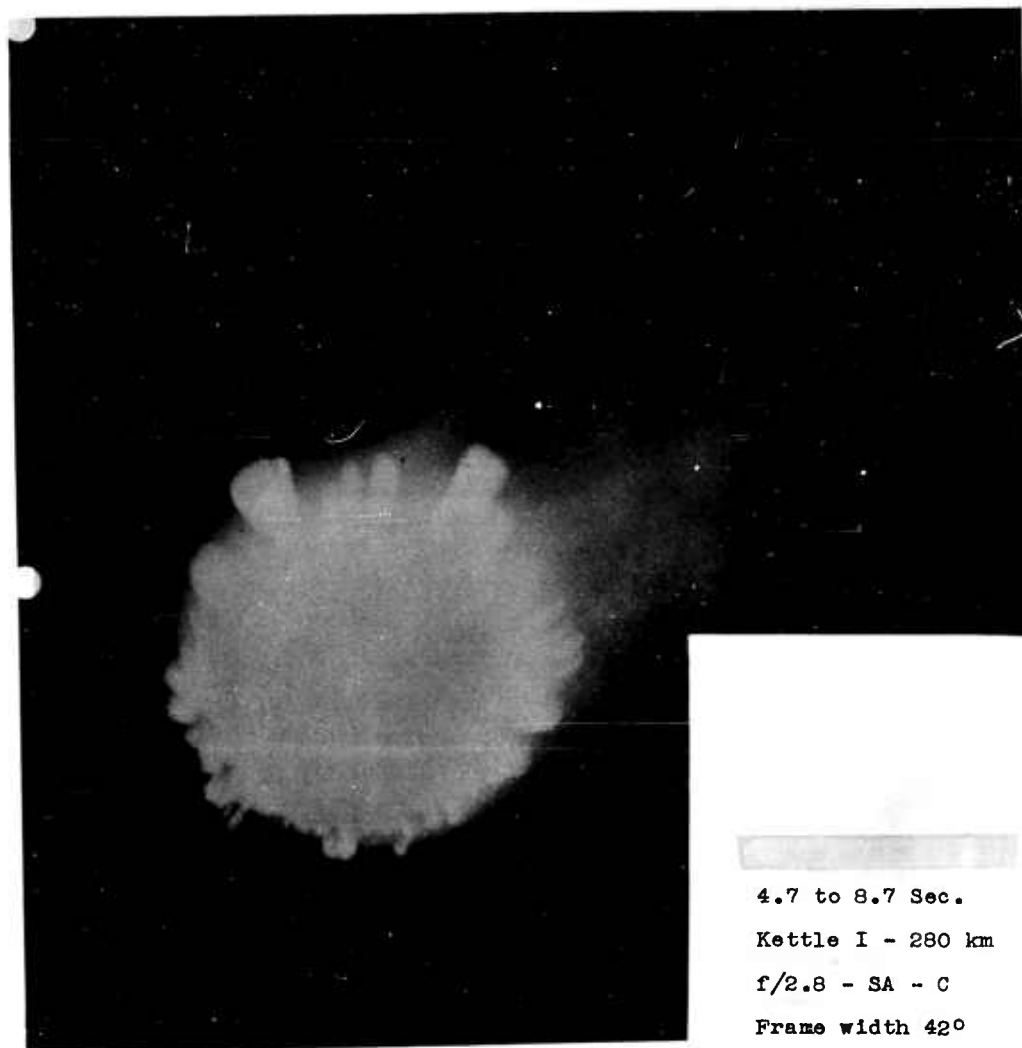


Figure 3.256 70-mm camera photo from Kettle I, Check Mate,  
4.7 to 8.7 seconds.

10.0 to 12.0 Sec.

Kettle I - 280 km

f/2.8 - SA - C

Frame width 42°

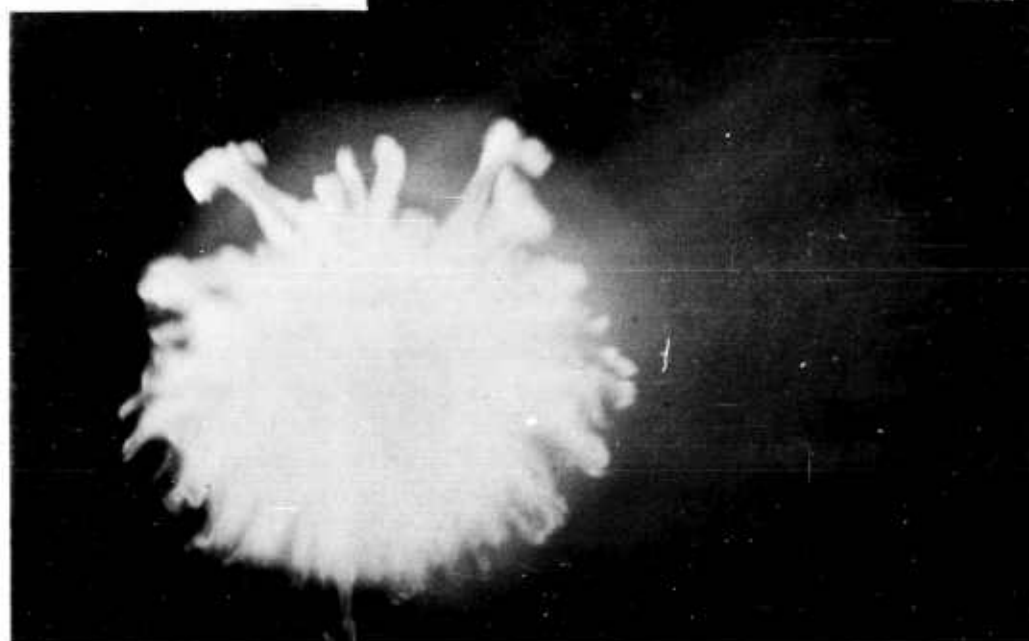


Figure 3.257 70-mm camera photo from Kettle I, Check Mate,  
10.0 to 12.0 seconds.

20.0 to 27.0 sec  
Kettle I - 280 km  
f/2.8 - SA-C  
Frame width 420

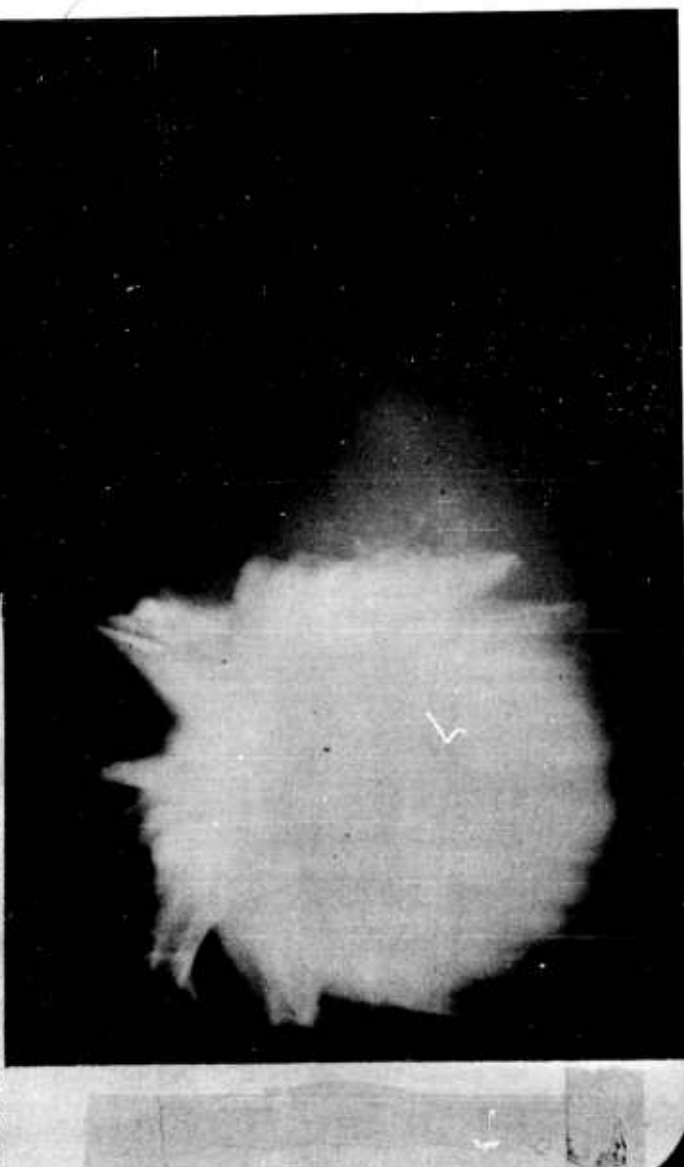


Figure 3.258 70-mm camera photo from Kettle I, Check Mate,  
20.0 to 27.0 seconds.

40.0 to 64.5 sec  
Kettle I - 280 km  
f/2.8 - SA-C  
Frame width 420



Figure 3.259 70-mm camera photo from Kettle I, Check Mate,  
40.0 to 64.5 seconds.



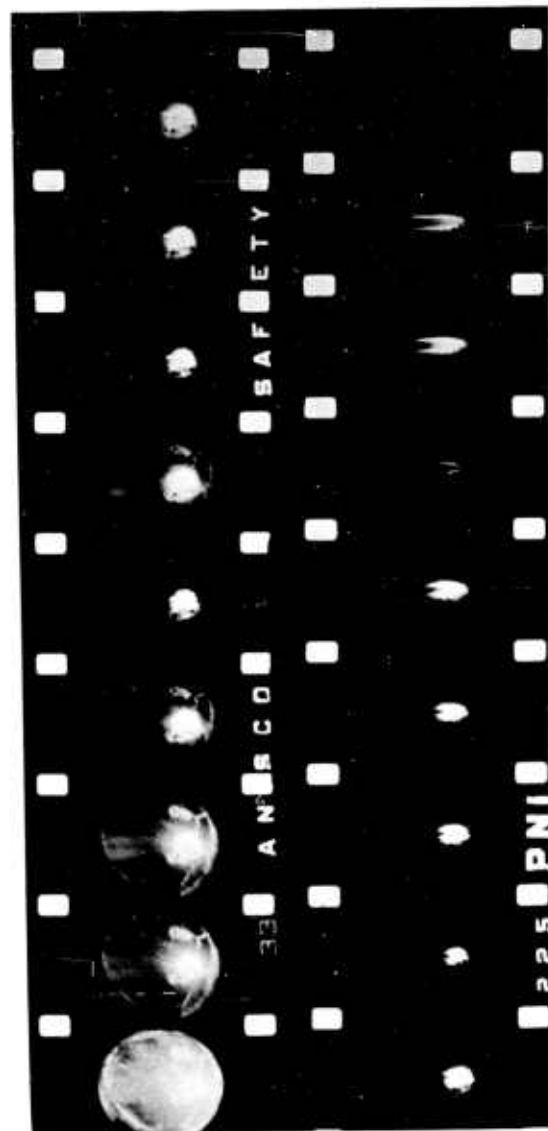
91.7 to 98.7 sec  
Kettle I - 280 km  
f/2.8 - SA-C  
Frame Width 42°

Figure 3.260 70-mm camera photo from Kettle I, Check Mate,  
91.7 to 98.7 seconds.

186 to 210 sec  
Kettle I - 280 km  
f/2.8 - SA-C  
Frame width 42°



Figure 3.261 70-mm camera photo from Kettle I, Check Mate,  
186 to 210 seconds.



Top row: Burst to 33.0 sec  
 Bottom row: 33.5 to 187.0 sec  
 Exposure times from 1 to 25 sec  
 Johnston - 165 km from burst  
 f/1.5 - Super Anscochrome  
 All-Sky Frame Height 155°  
 Camera axis 6° N from vertical

Figure 3.262 All-sky camera photos from Johnston, Check Mate.



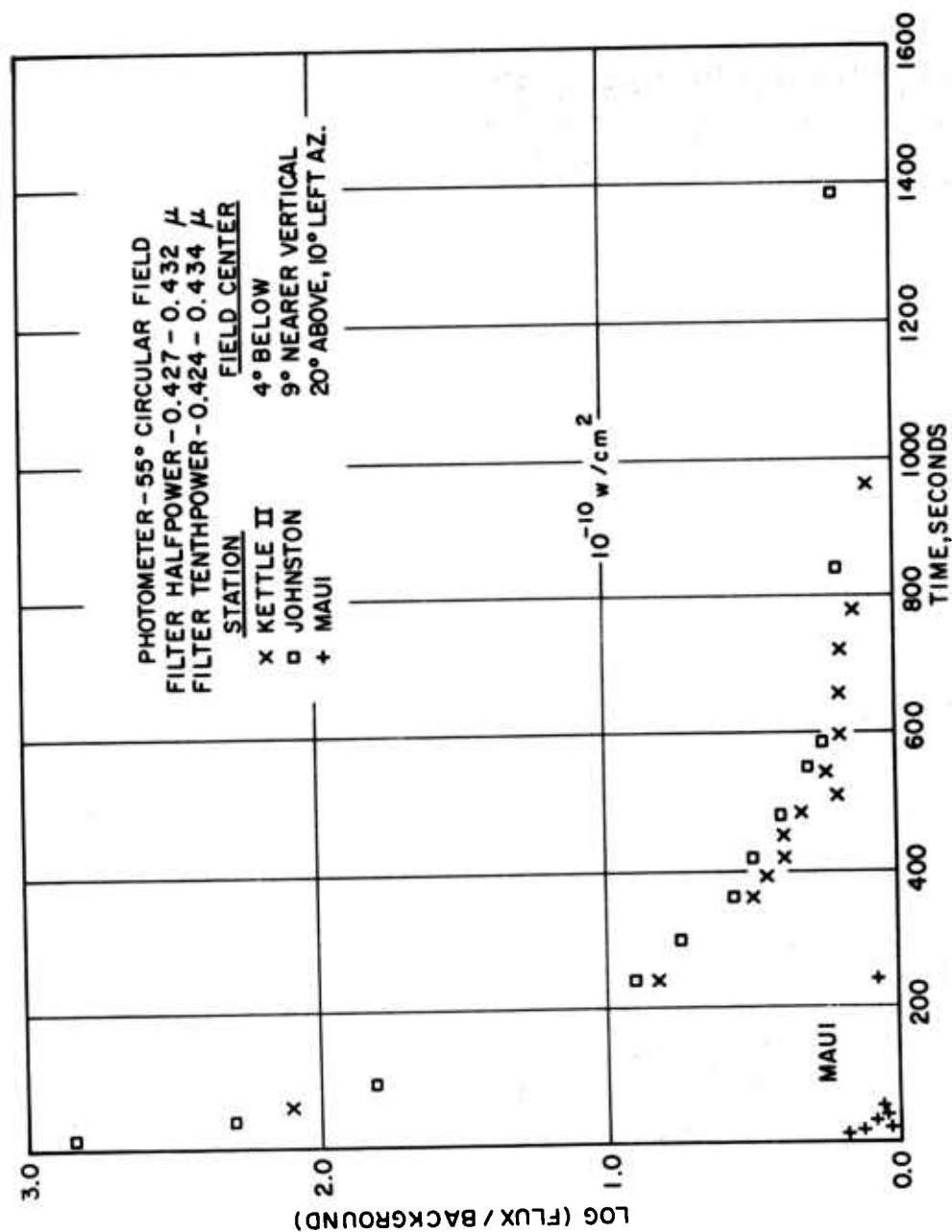


Figure 3.263 Photometer results, Check Mate, in spectral region 0.427 to 0.432  $\mu$ .

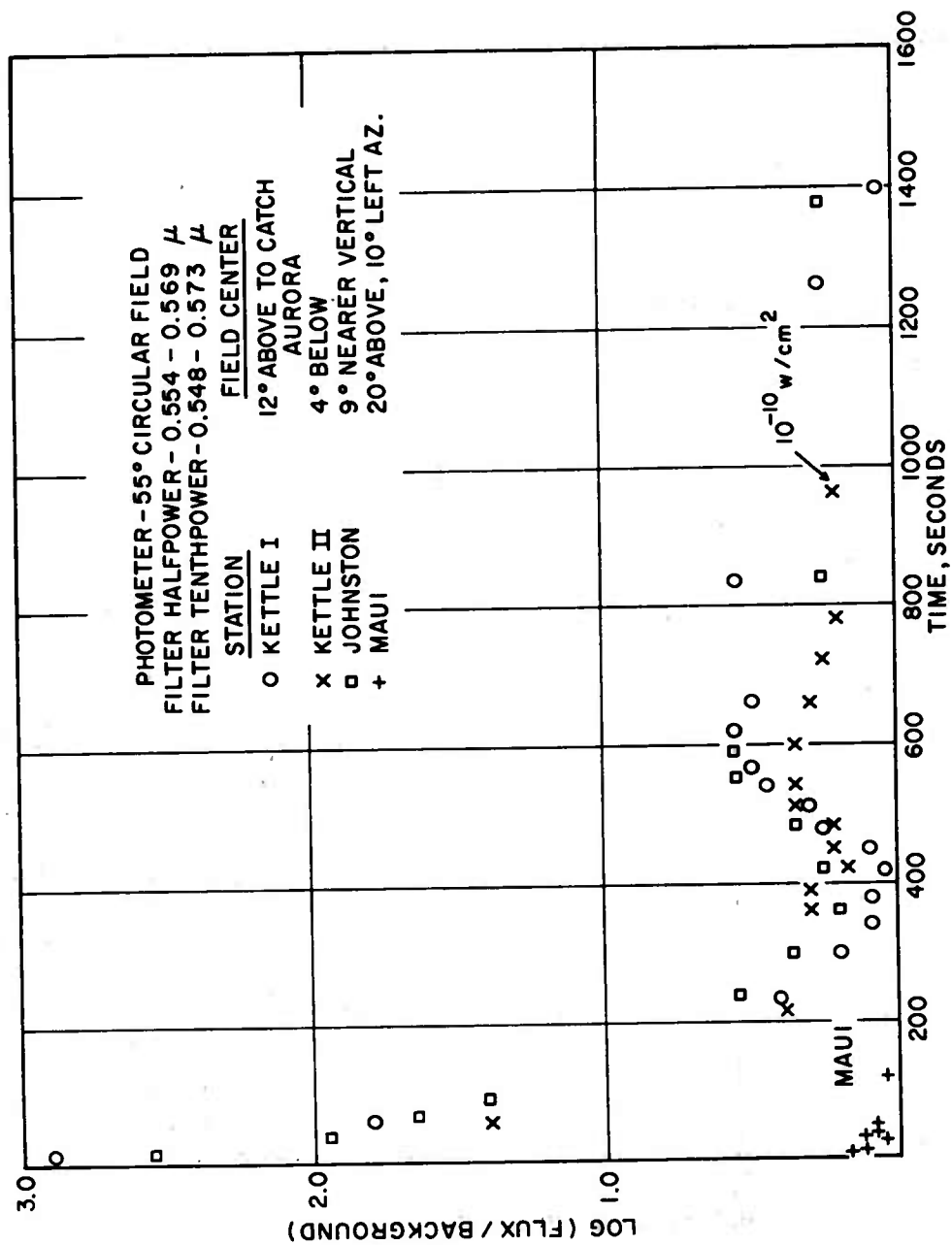


Figure 3.264 Photometer results, Check Mate, in spectral region 0.55 to 0.569  $\mu$ .

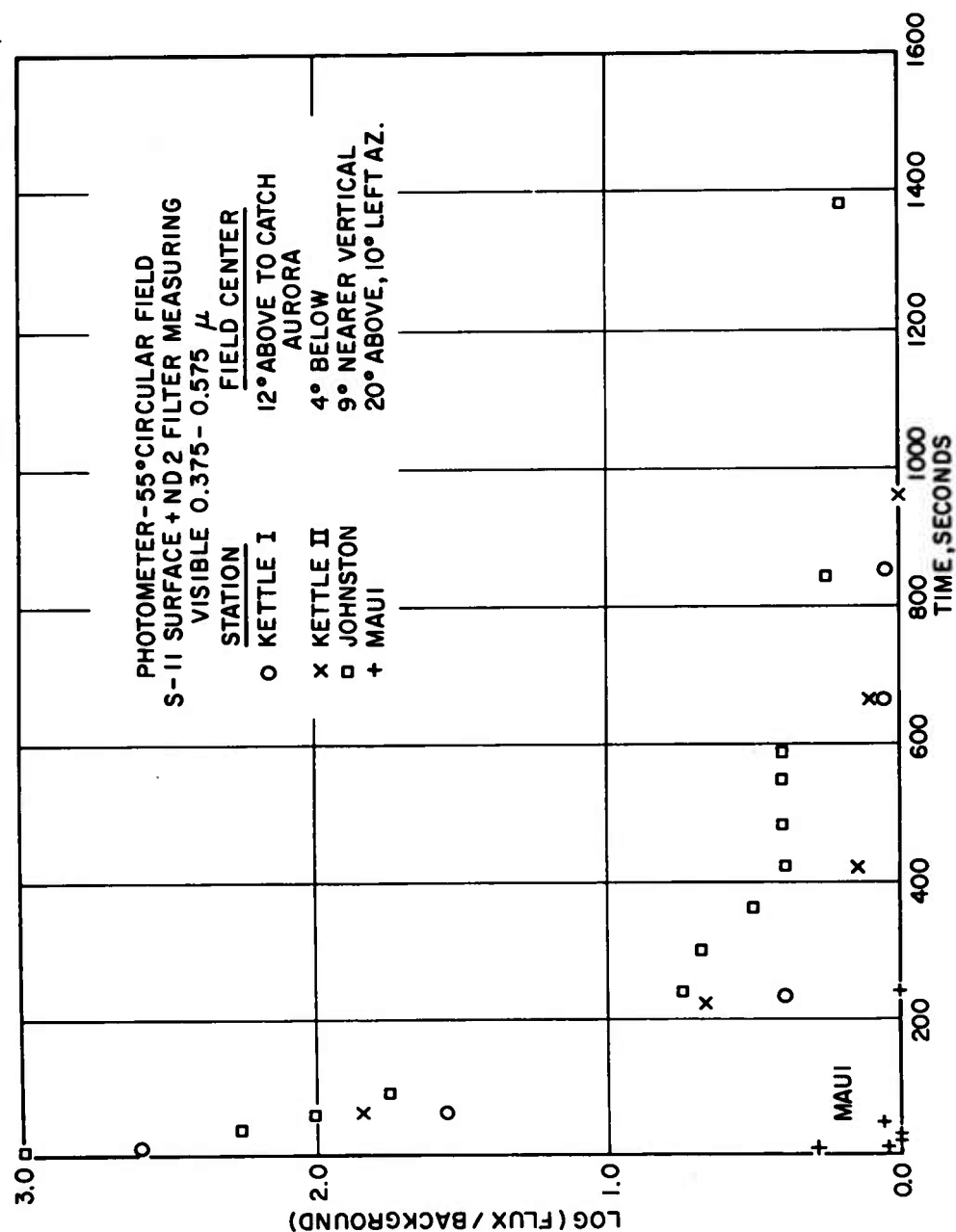


Figure 3.265 Photometer results, Check Mate, in spectral region 0.375 to 0.575  $\mu$

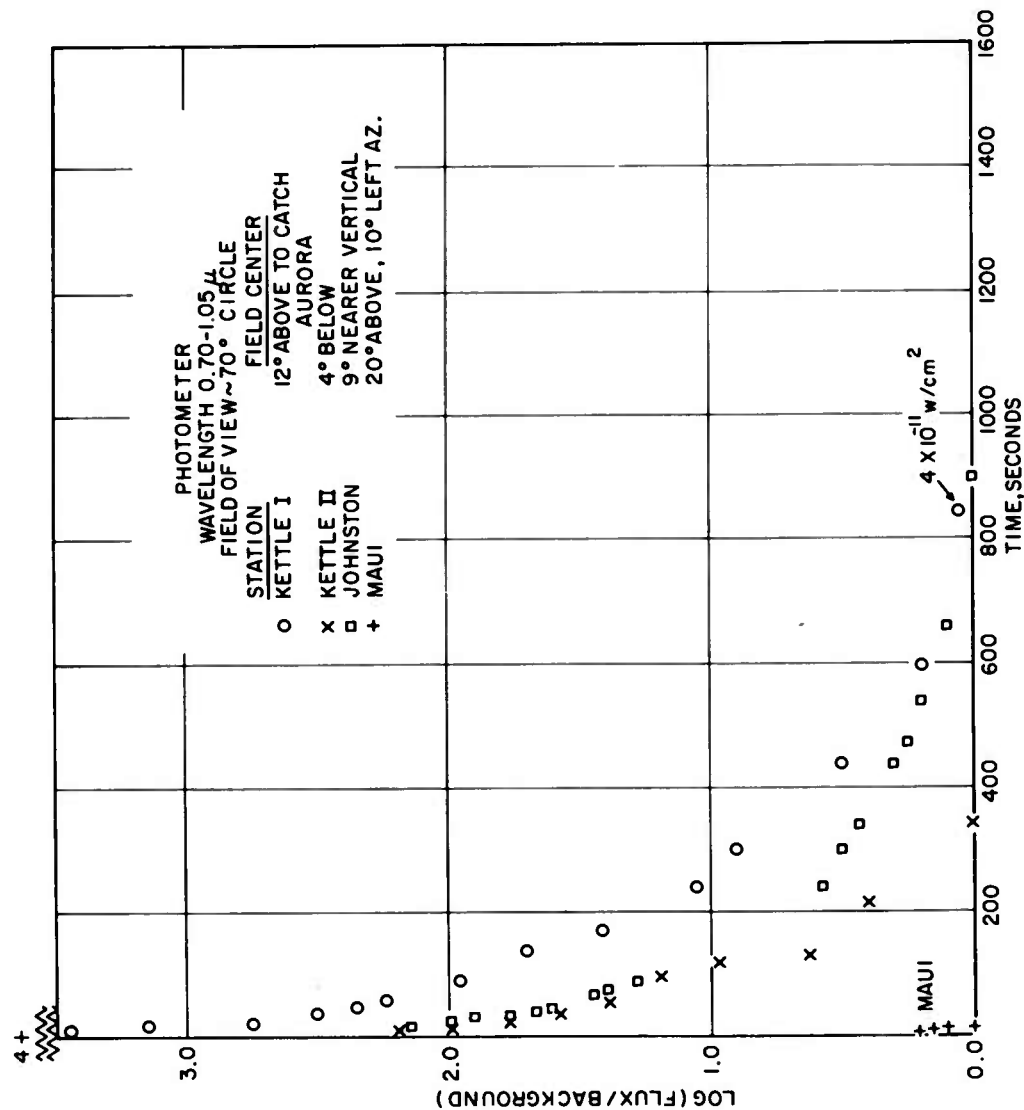


Figure 3.266 Photometer results, Check Mate, in spectral region 0.70 to 1.05  $\mu$ .

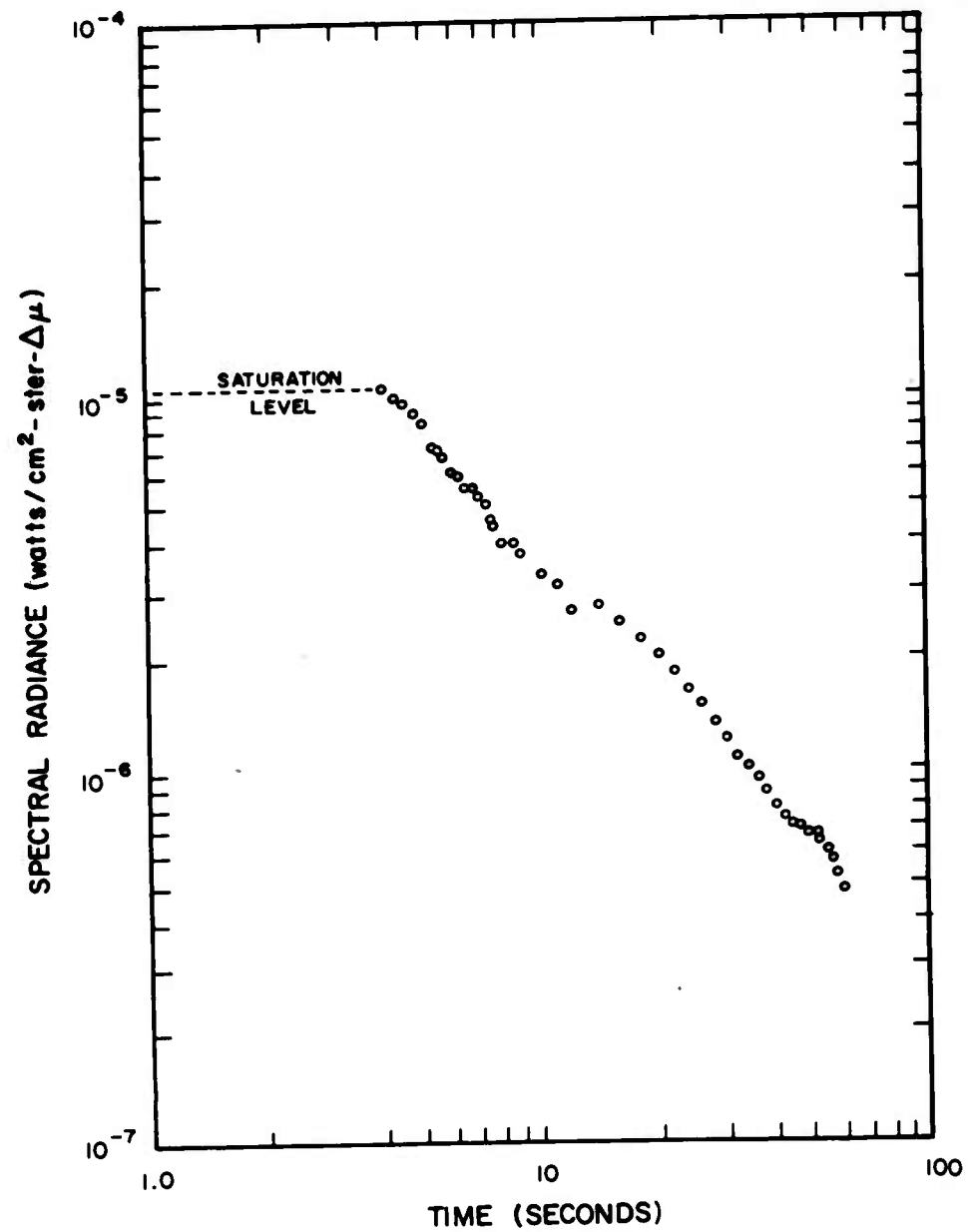


Figure 3.267 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 1, early time.

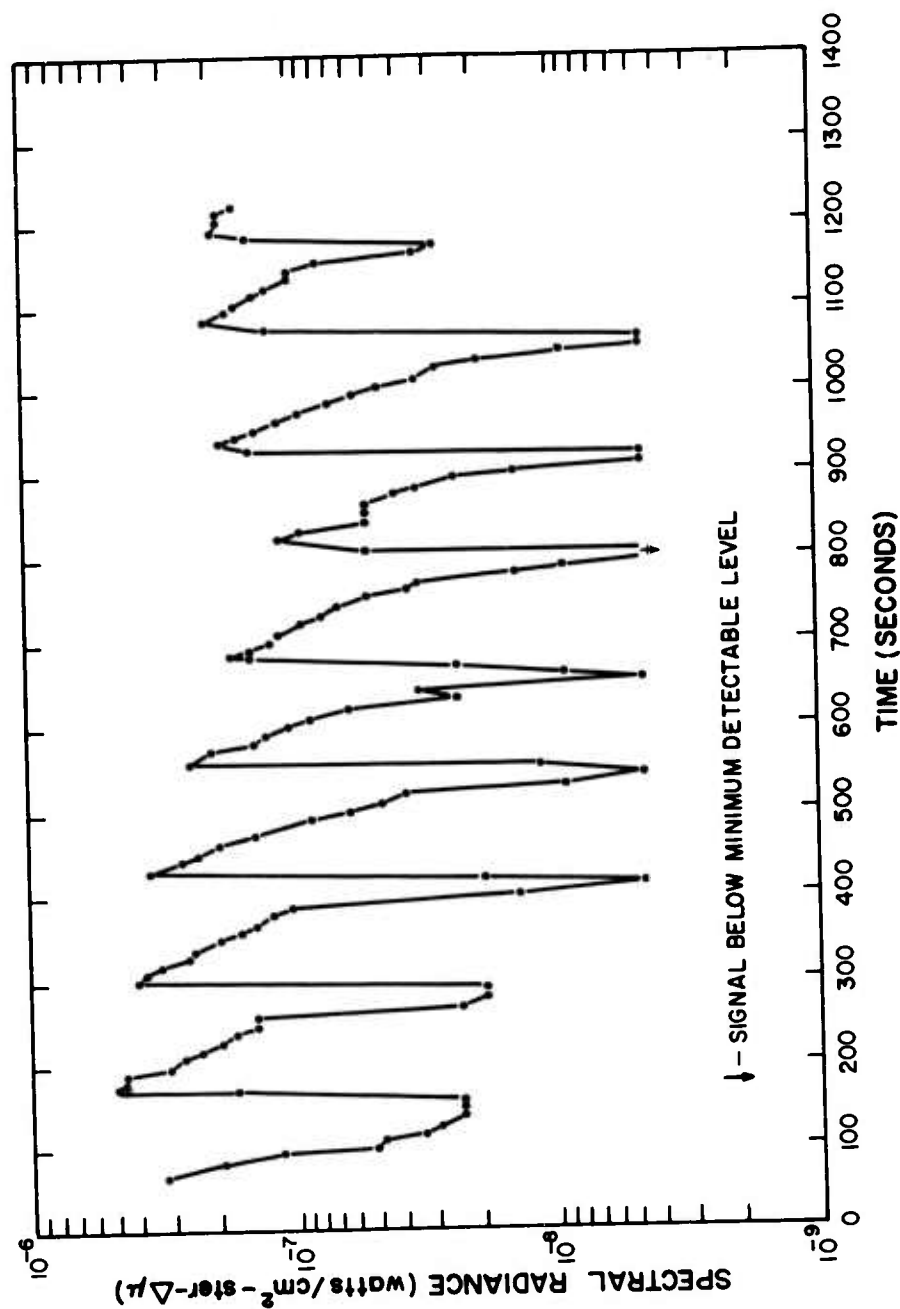


Figure 3.268 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 1, late time.

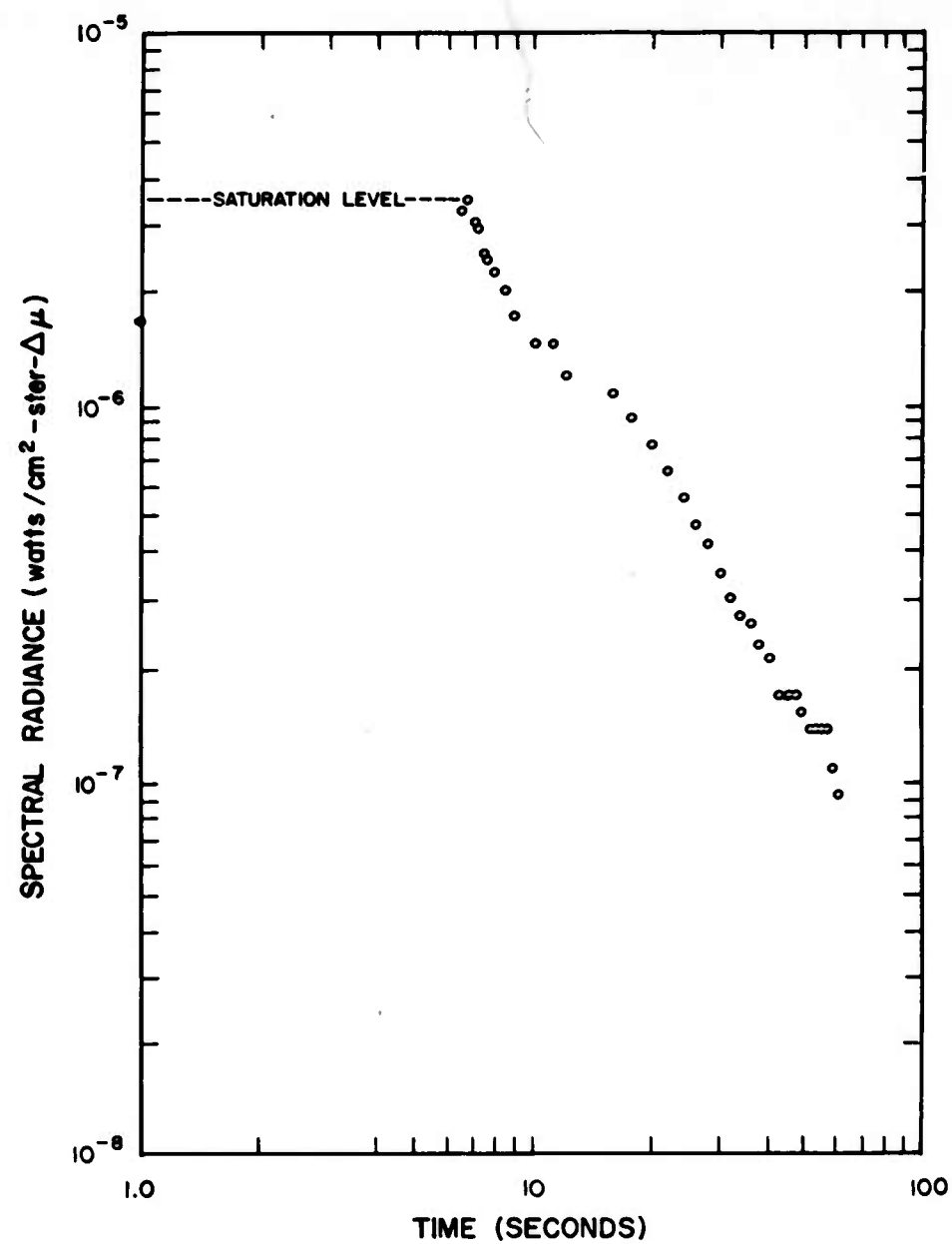


Figure 3.269 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 2, early time.

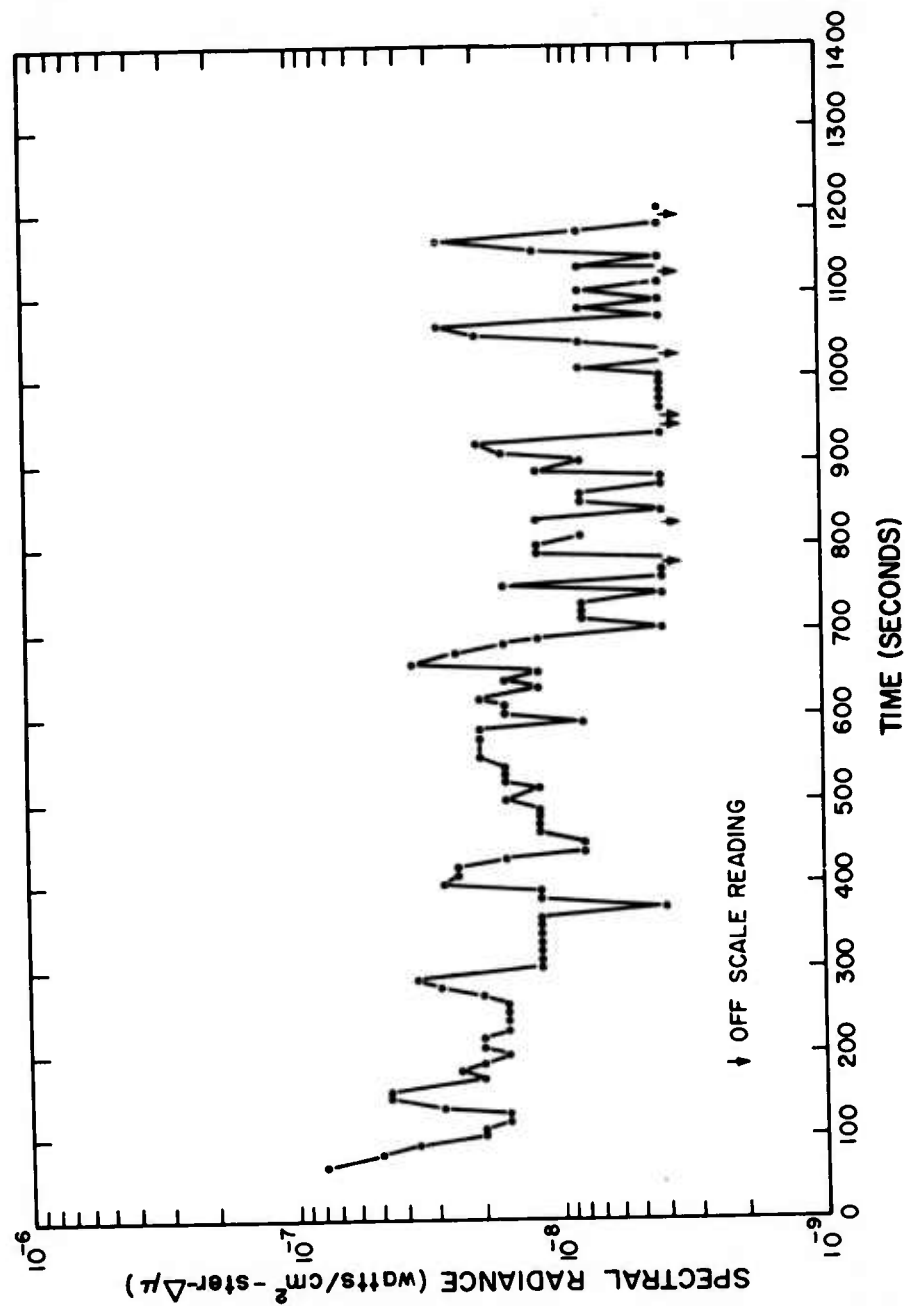


Figure 3.270 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 2, late time.



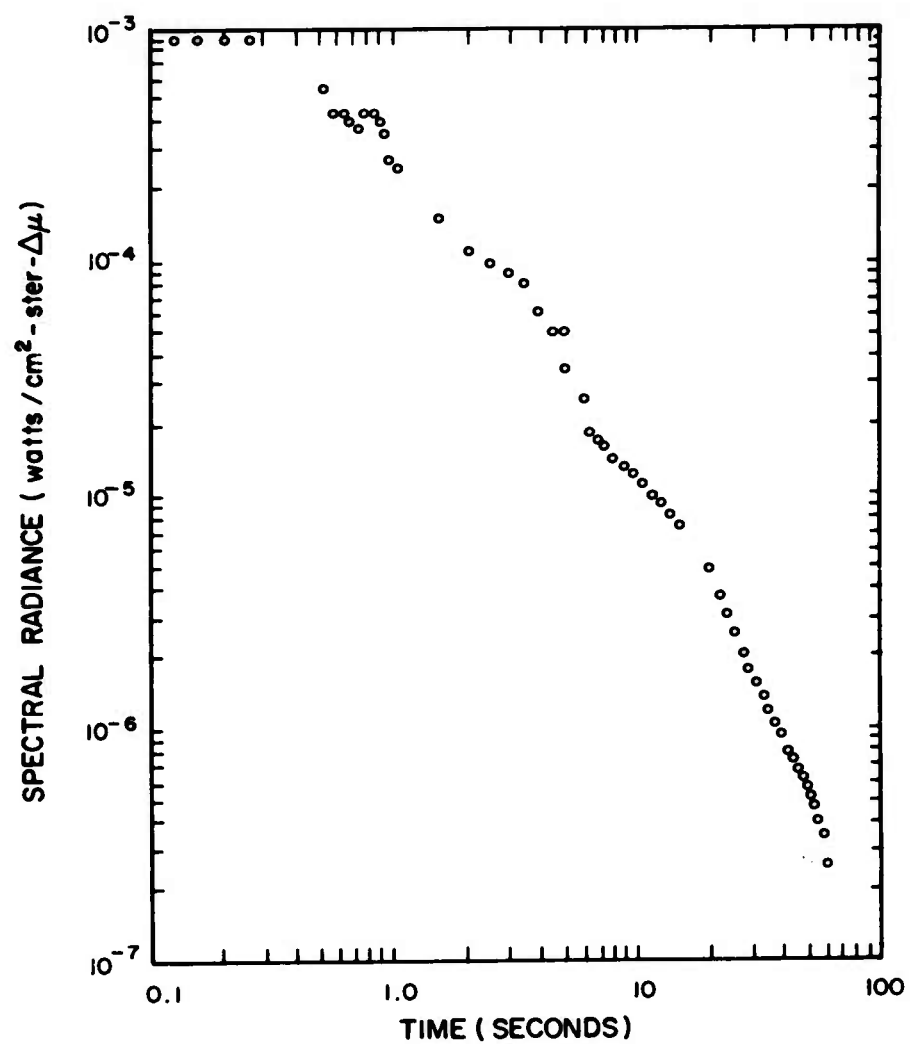


Figure 3.271 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 3, early time.

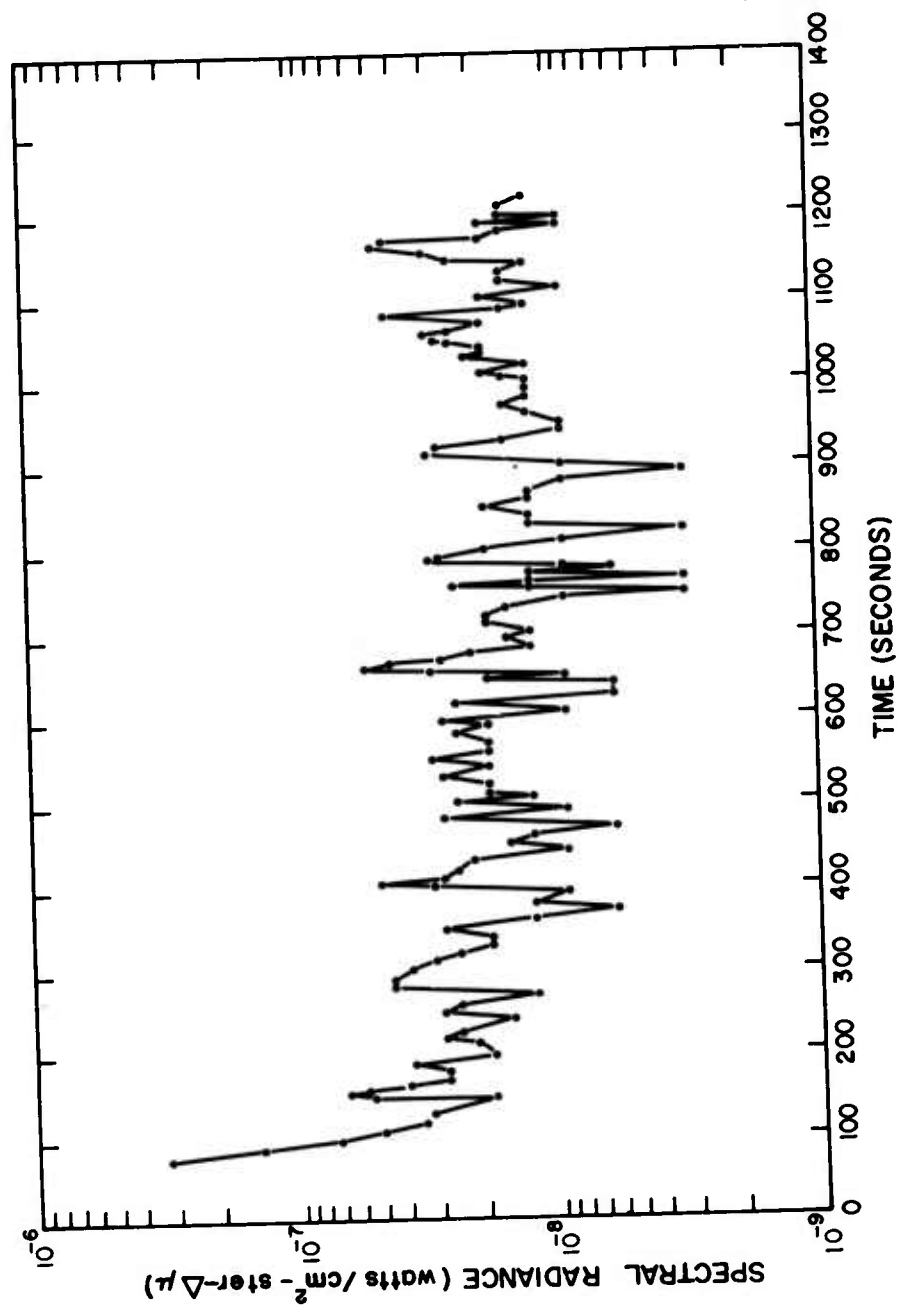


Figure 3.272 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 3, late time.

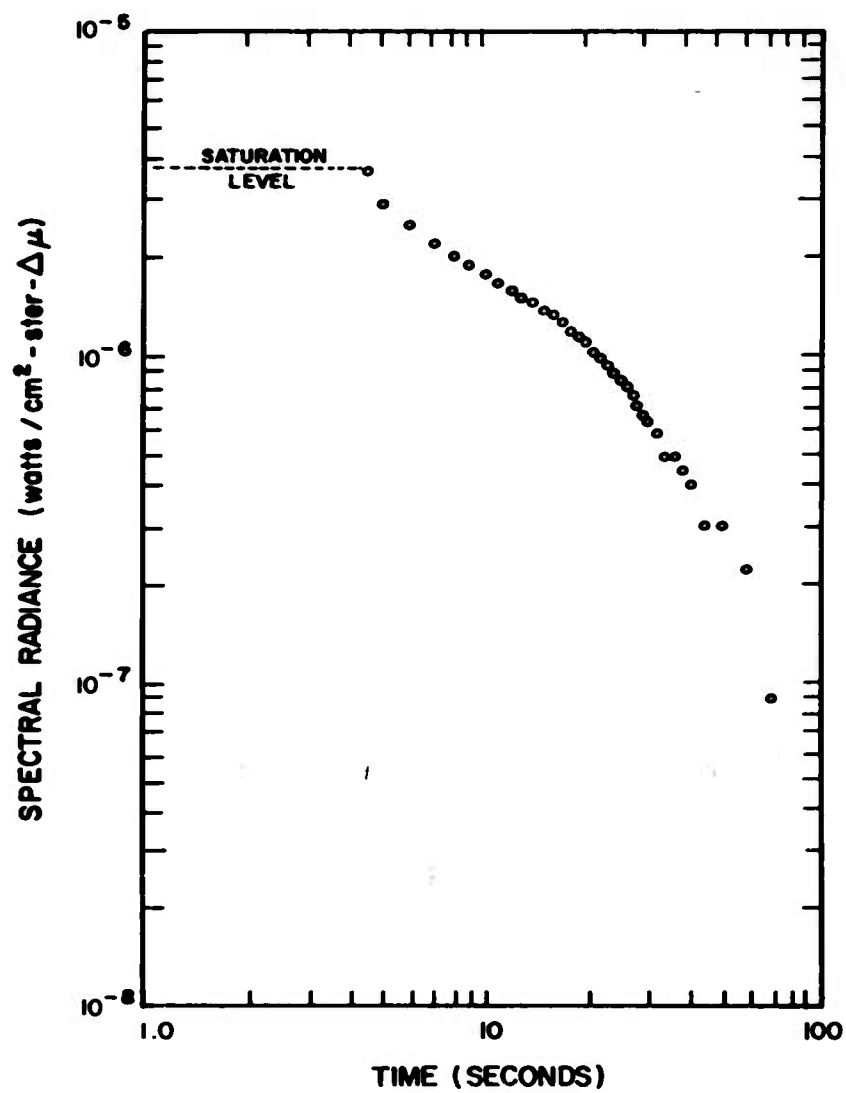


Figure 3.273 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 4, early time.

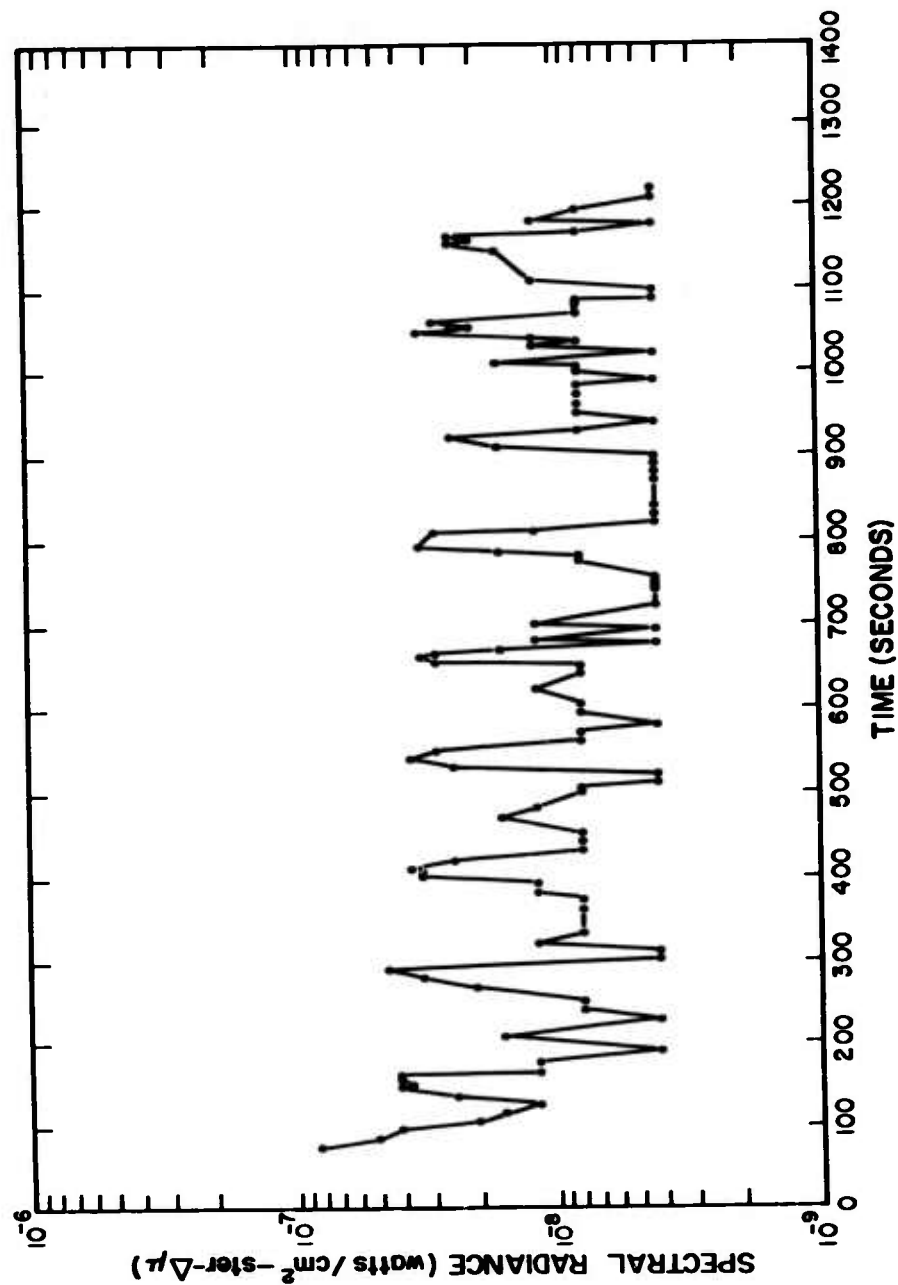


Figure 3.274 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 4, late time.

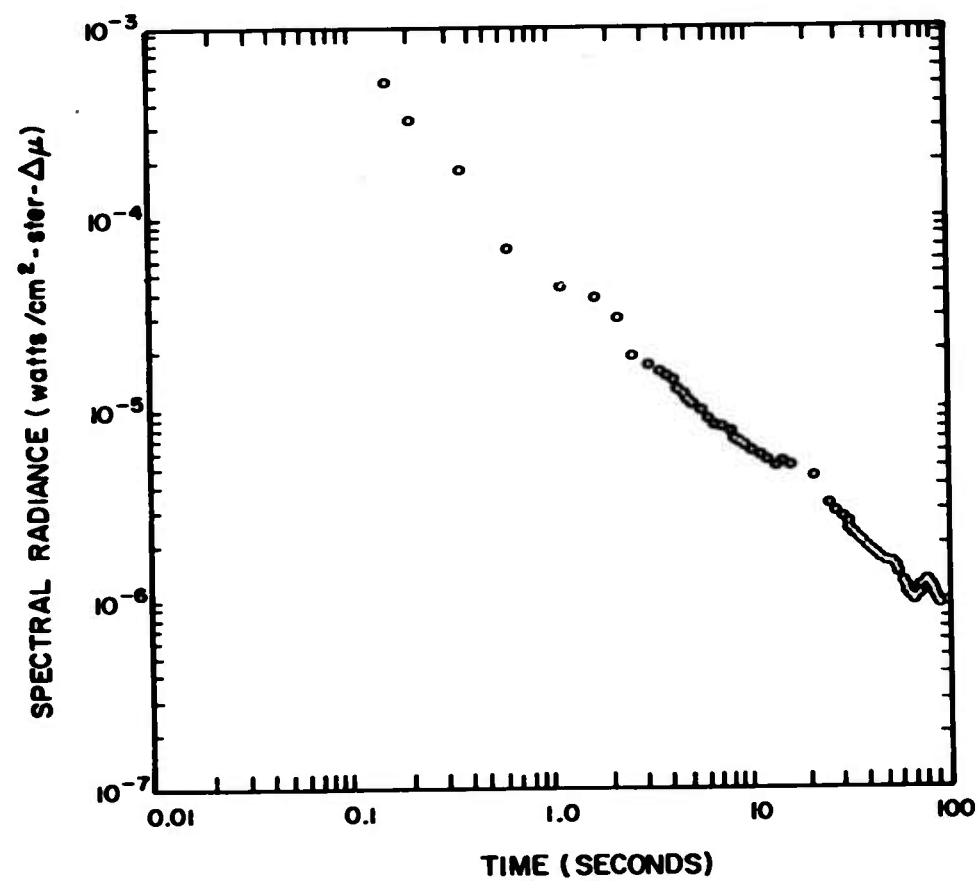


Figure 3.275 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 5, early time.

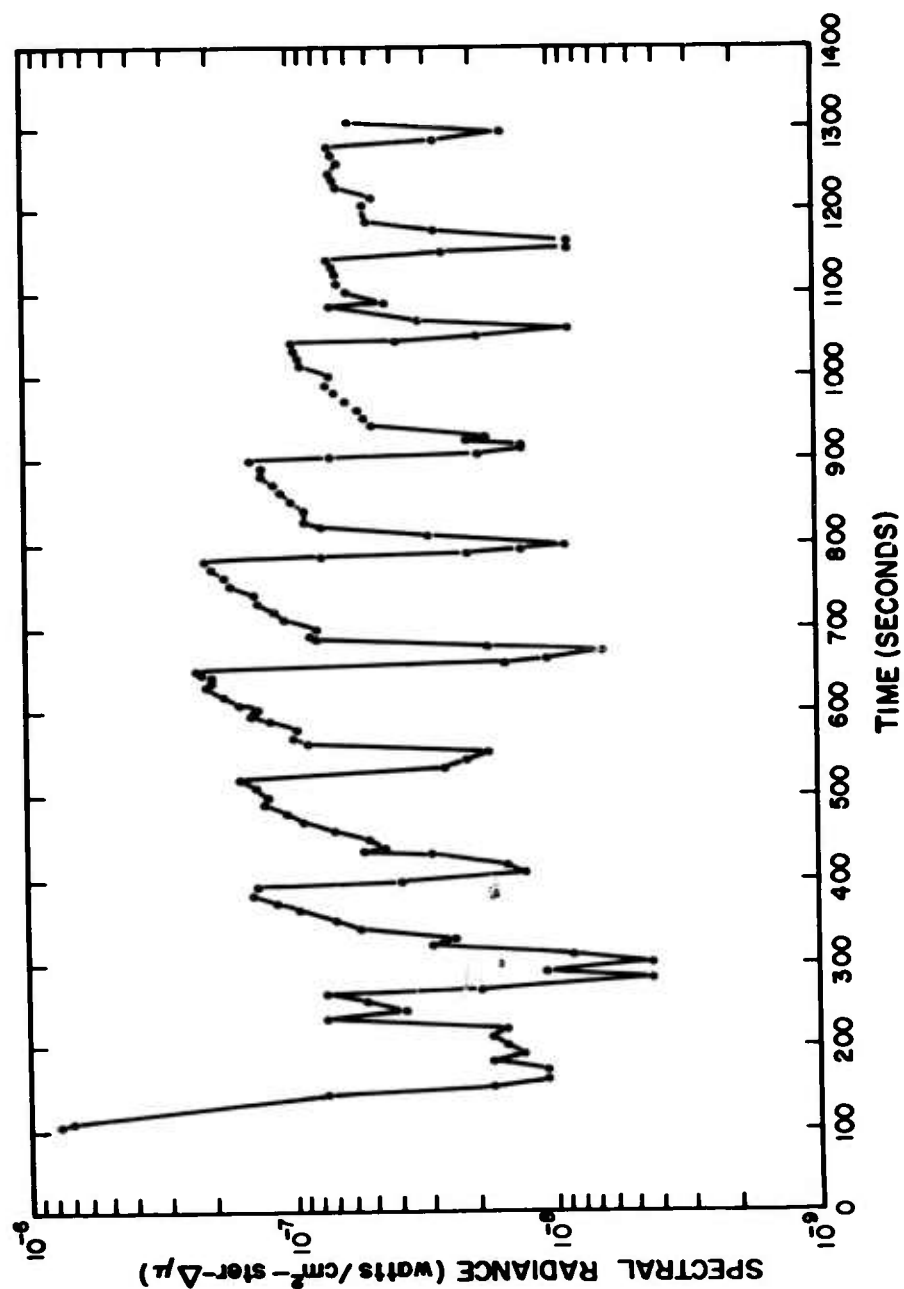


Figure 3.276 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 5, late time.

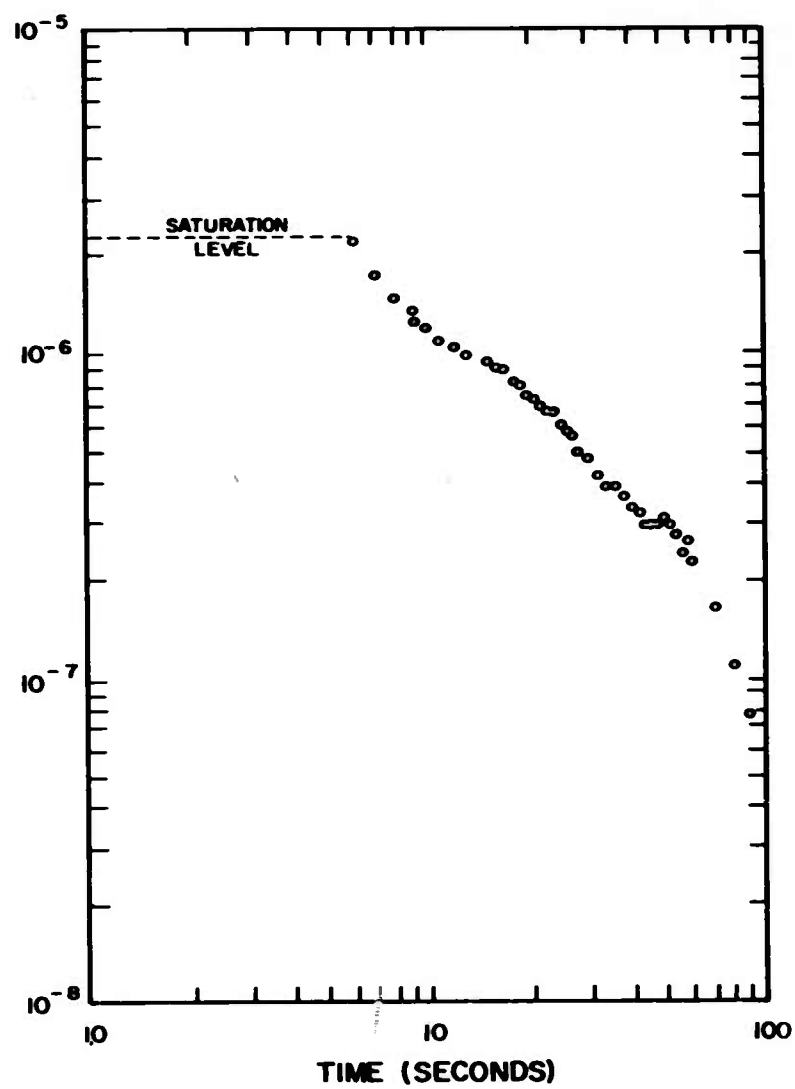


Figure 3.277 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 6, early time.

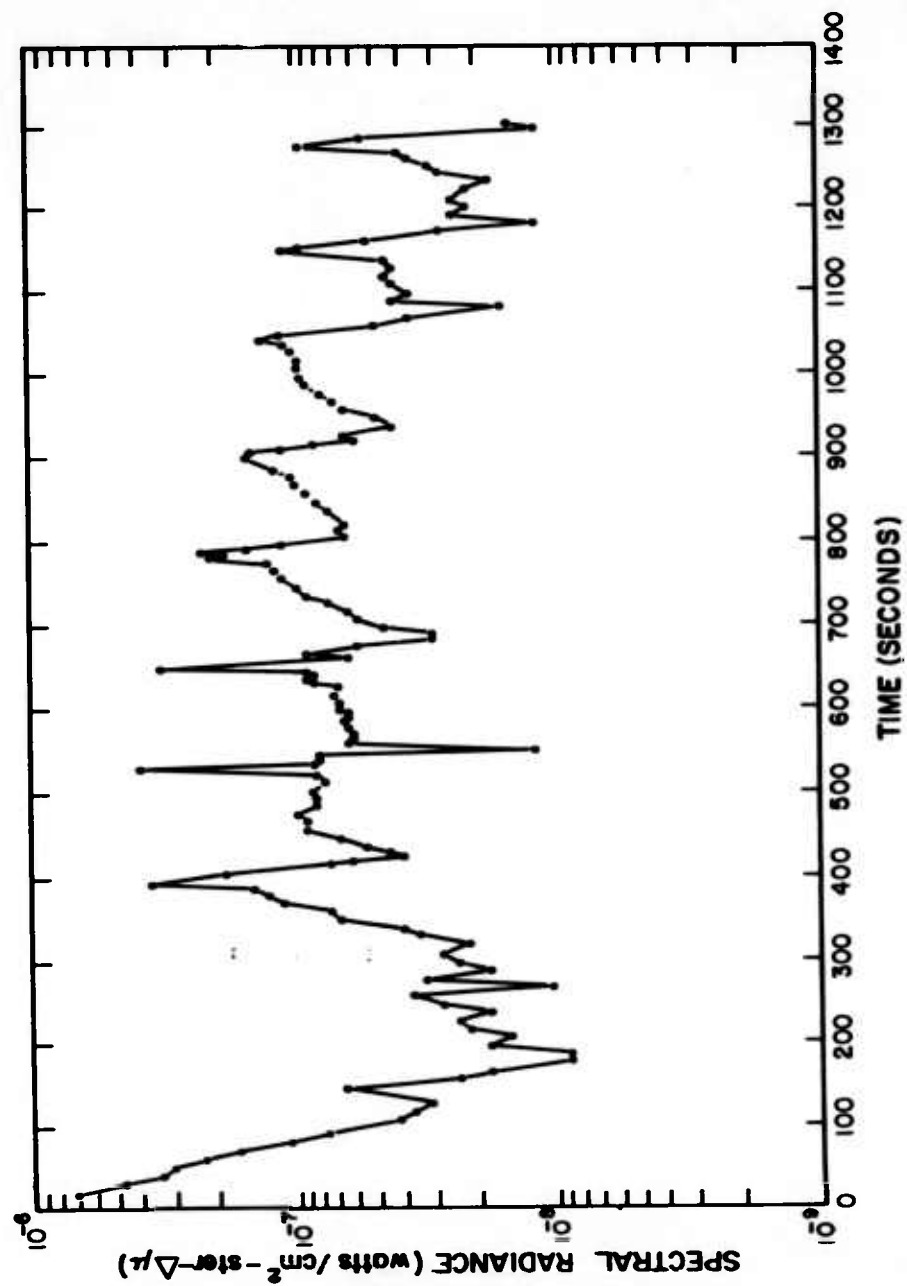


Figure 3.278 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 6, late time.



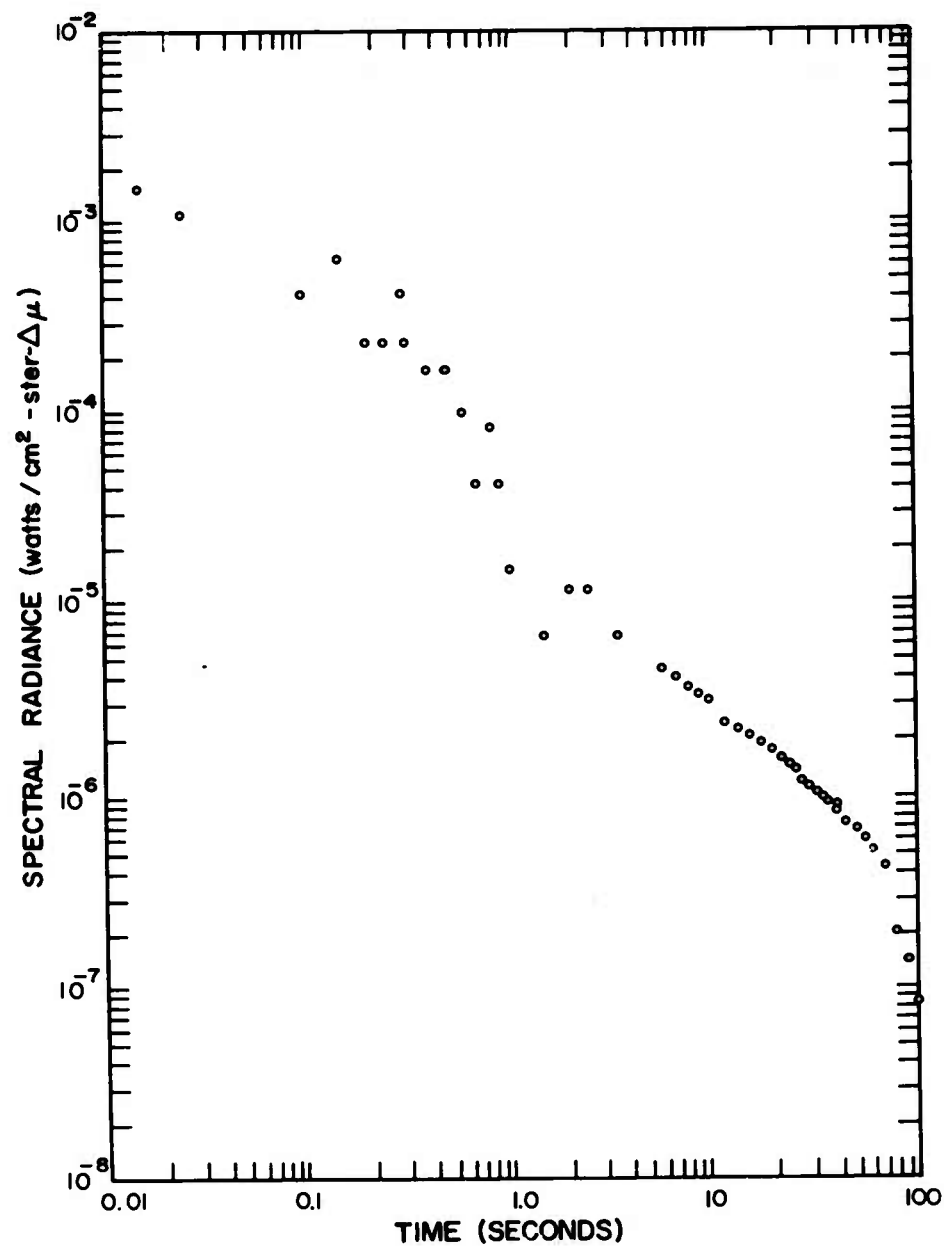


Figure 3.279 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 7, early time.

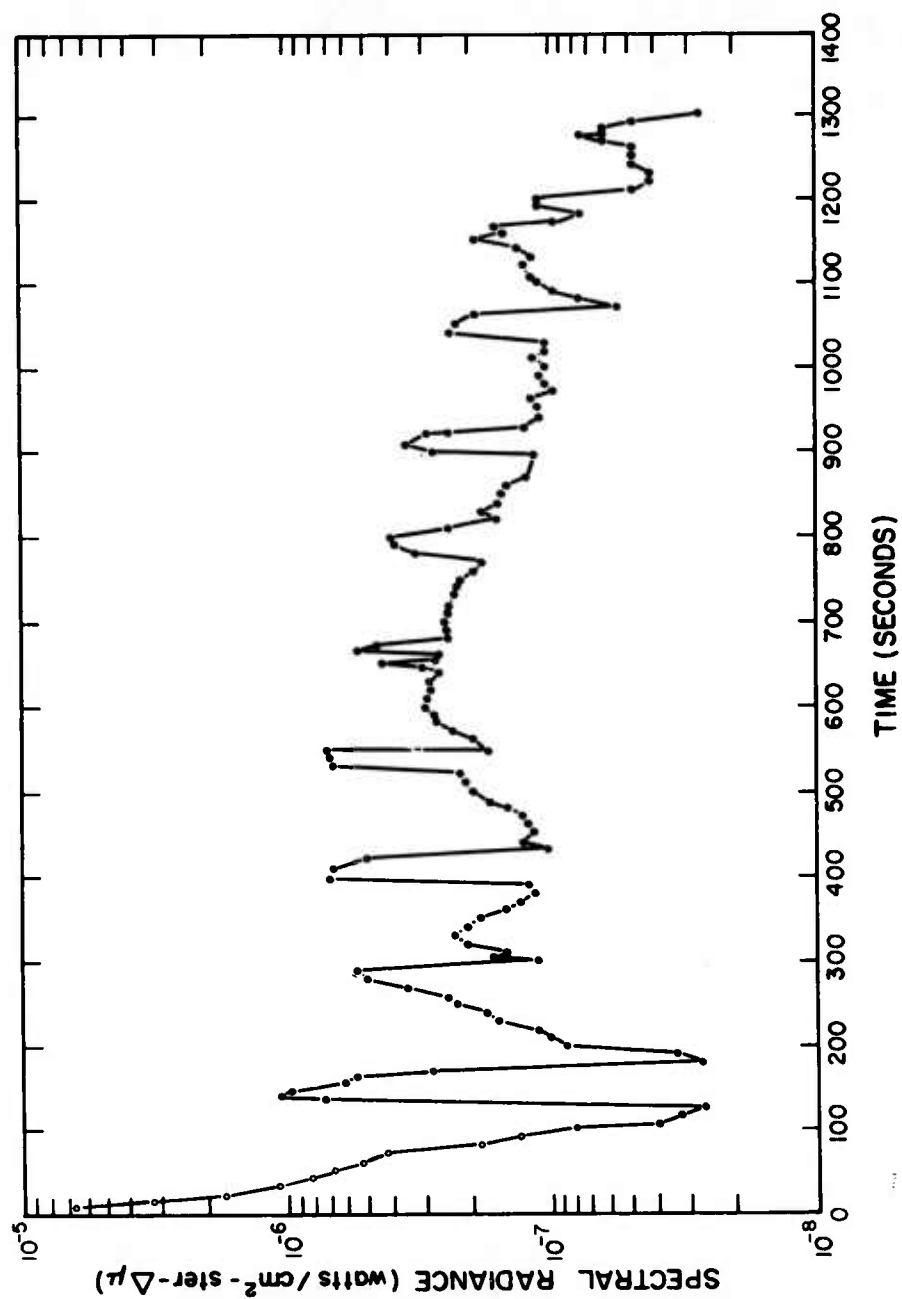


Figure 3.280 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 7, late time.

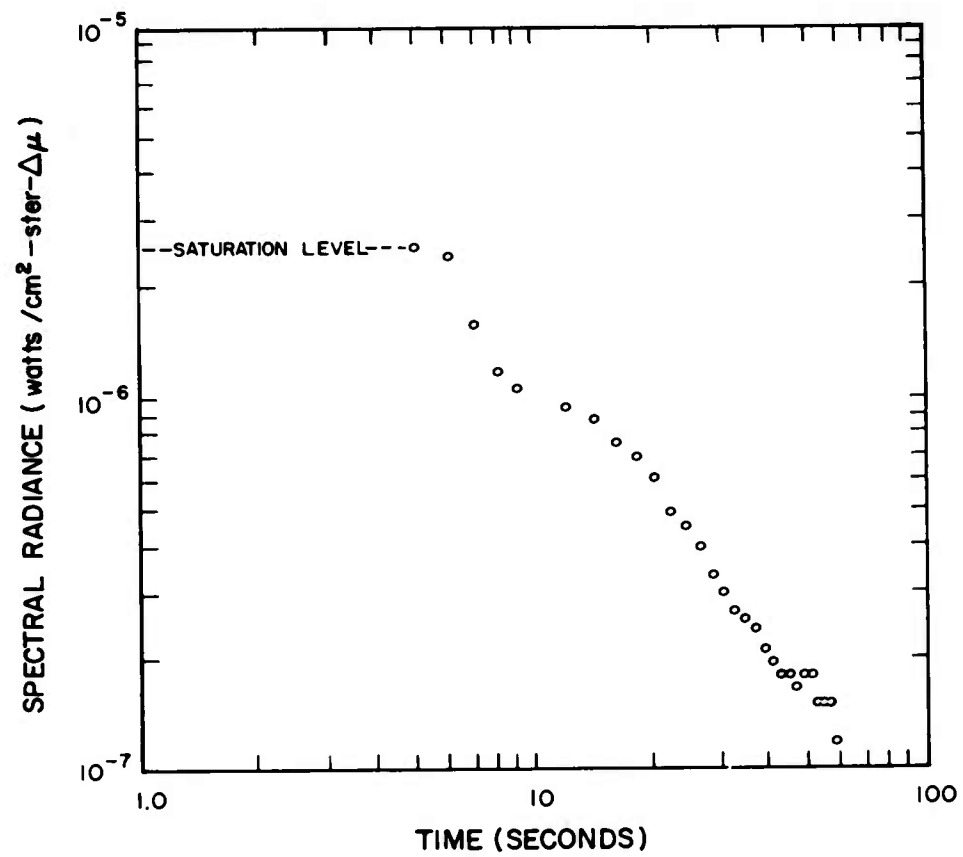


Figure 3.281 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 8, early time.

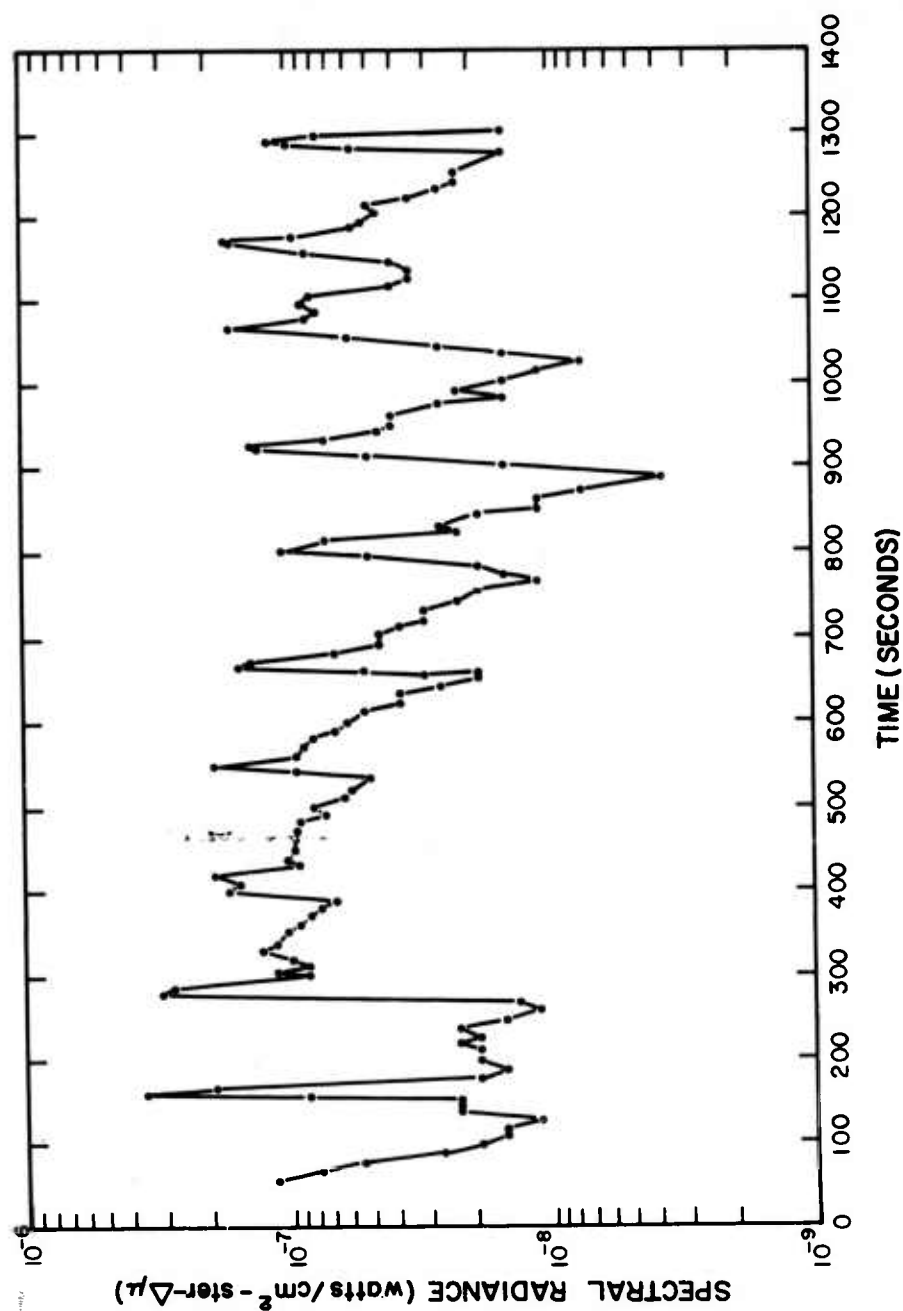


Figure 3.282 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 8, late time.

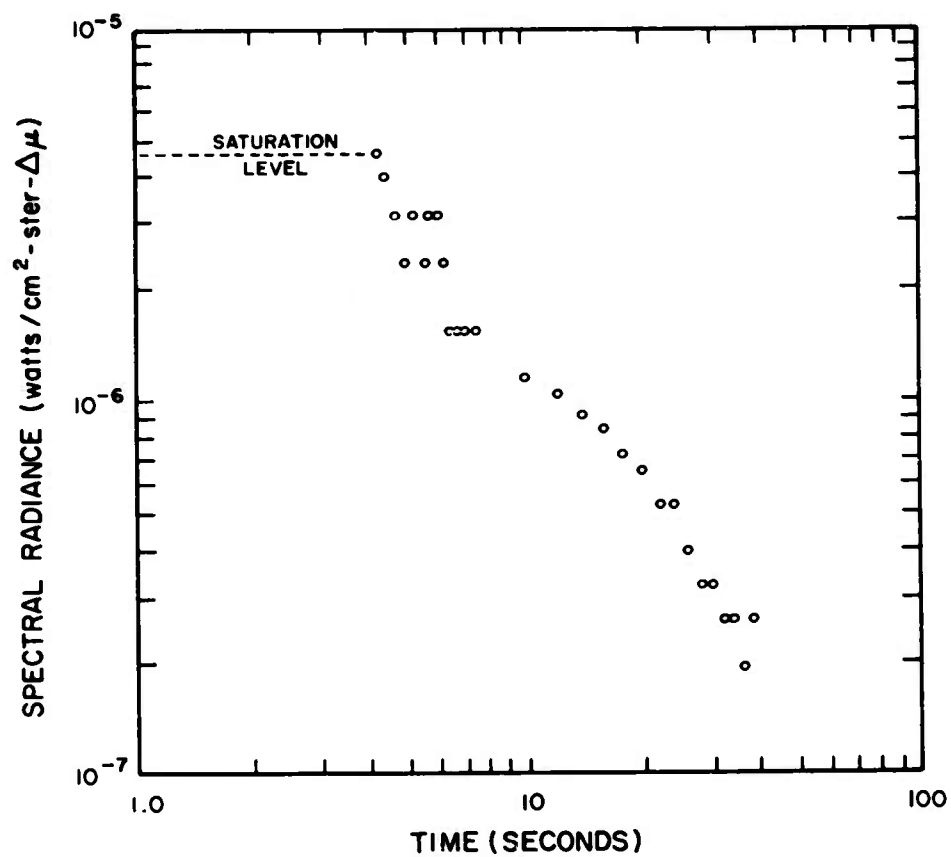


Figure 3.283 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 9, early time.

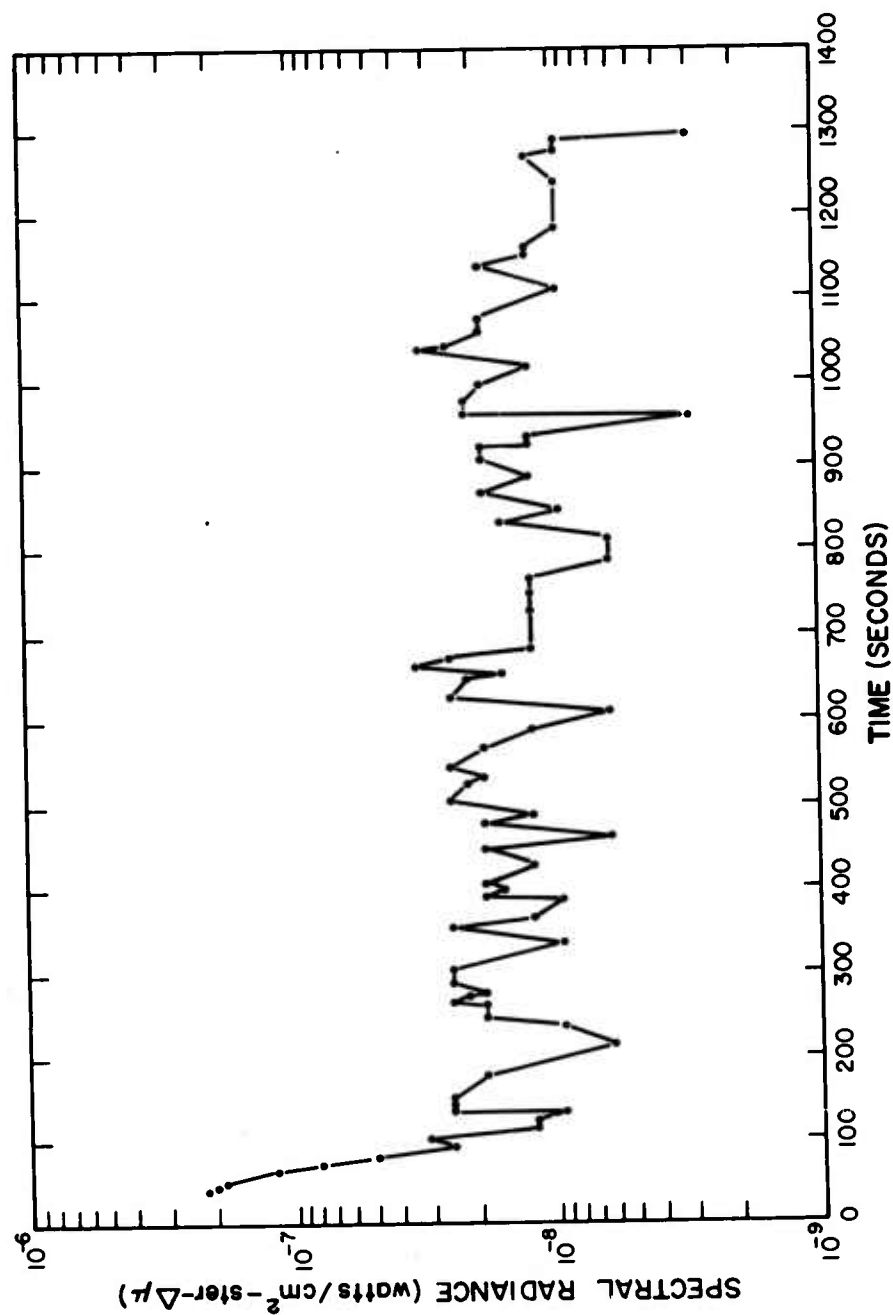


Figure 3.284 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 9, late time.

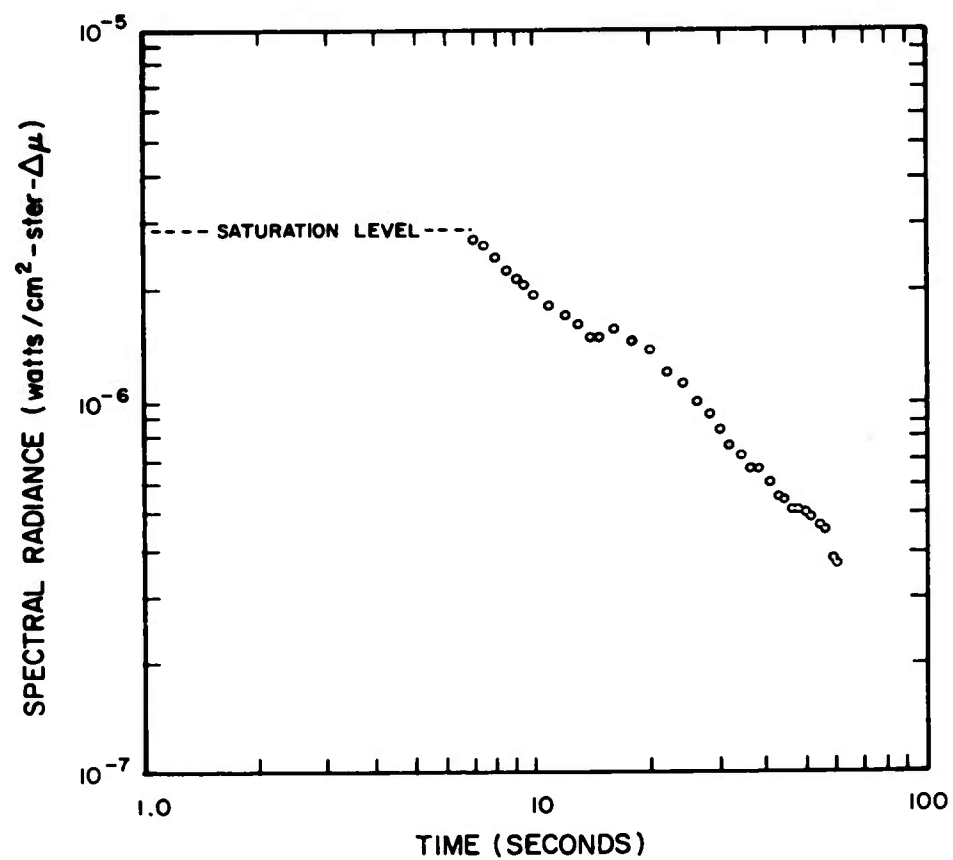


Figure 3.285 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 14, early time.

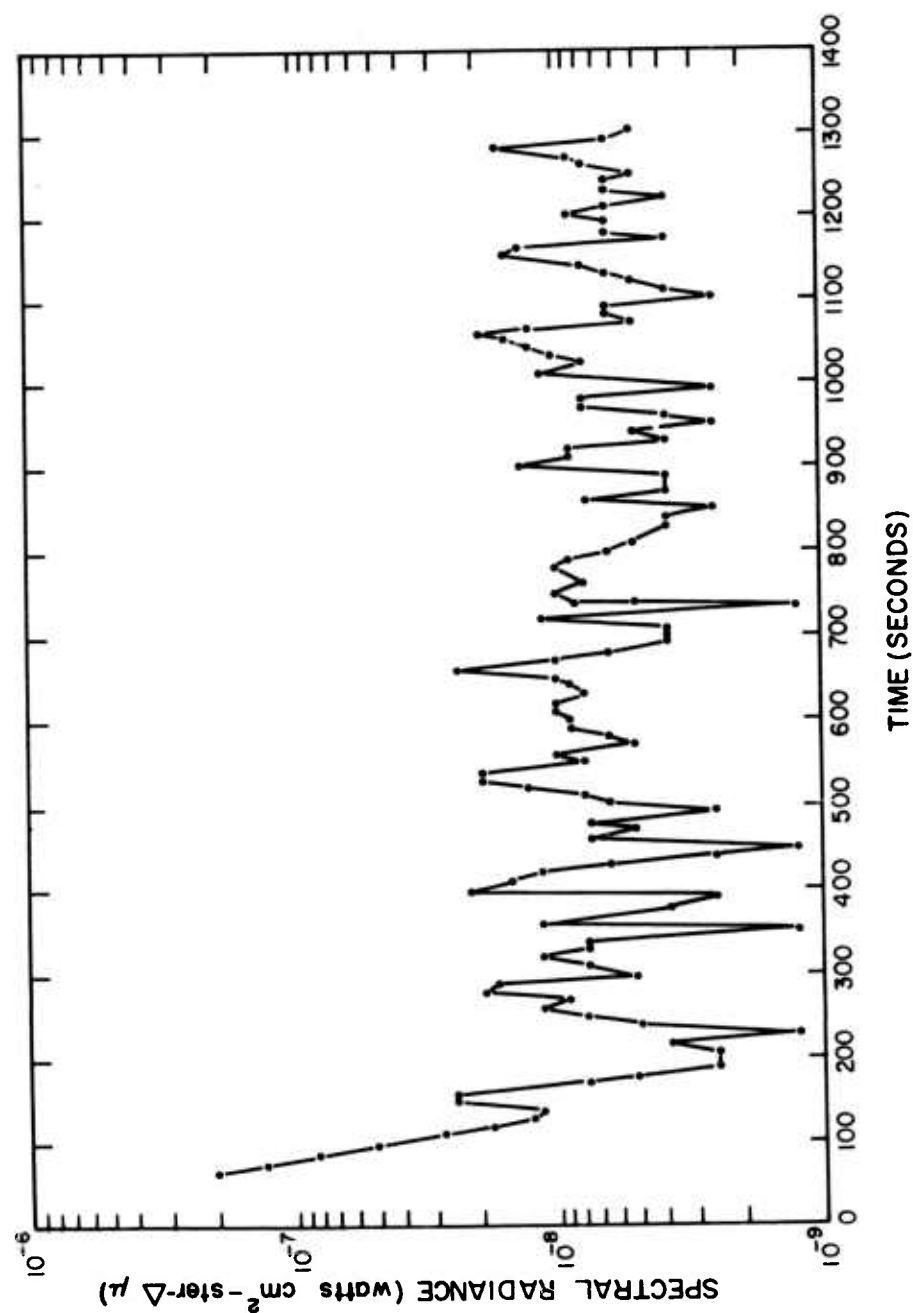


Figure 3.286 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 14, late time.



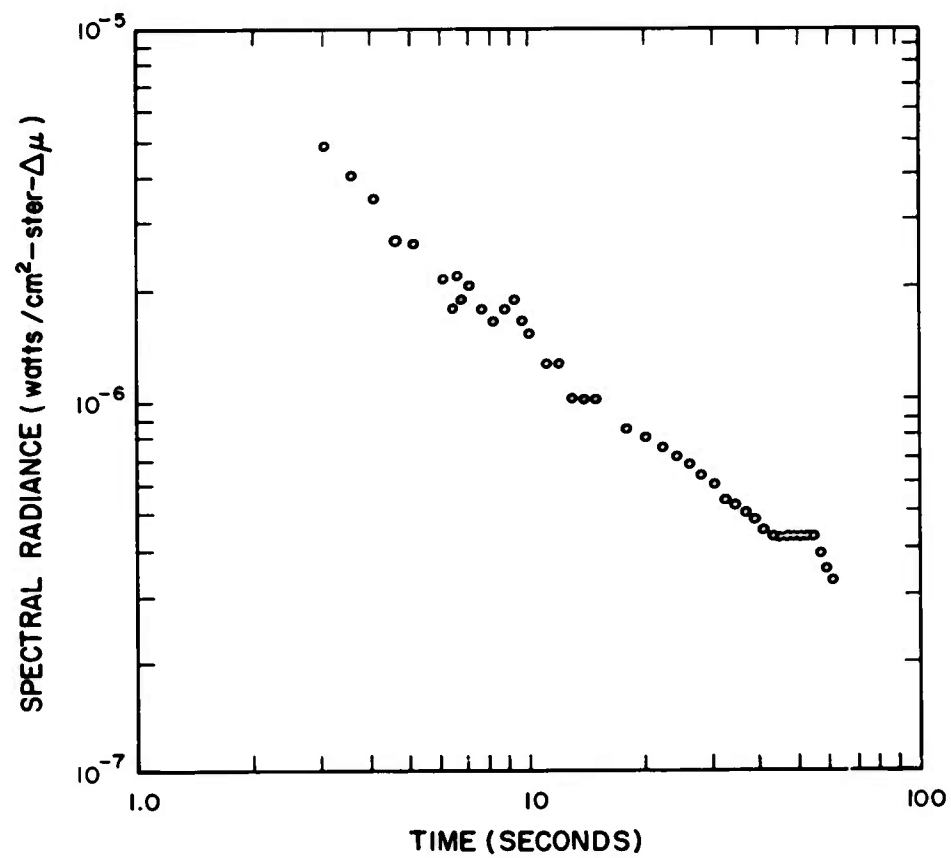


Figure 3.287 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 15, early time.

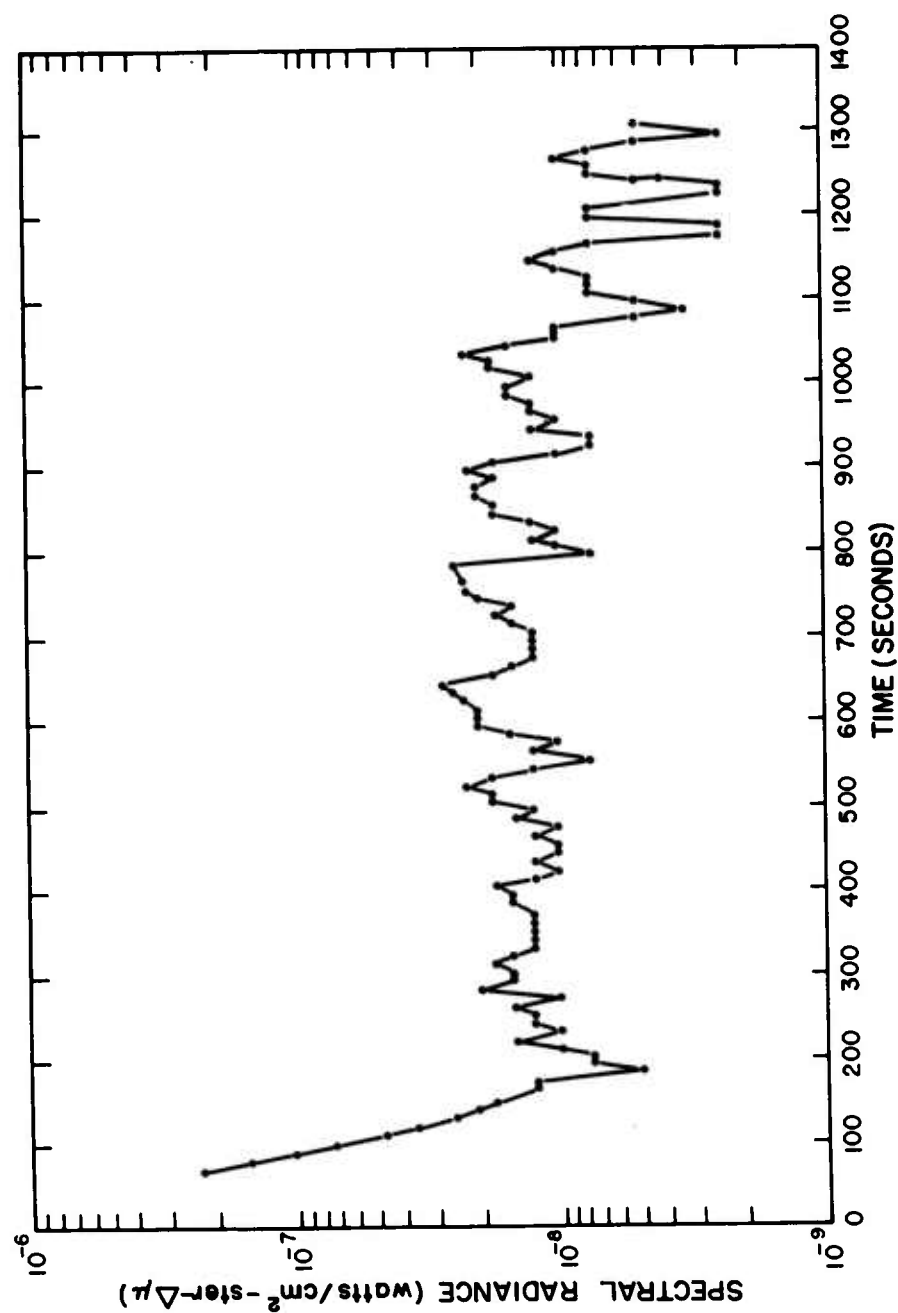


Figure 3.288 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 15, late time.

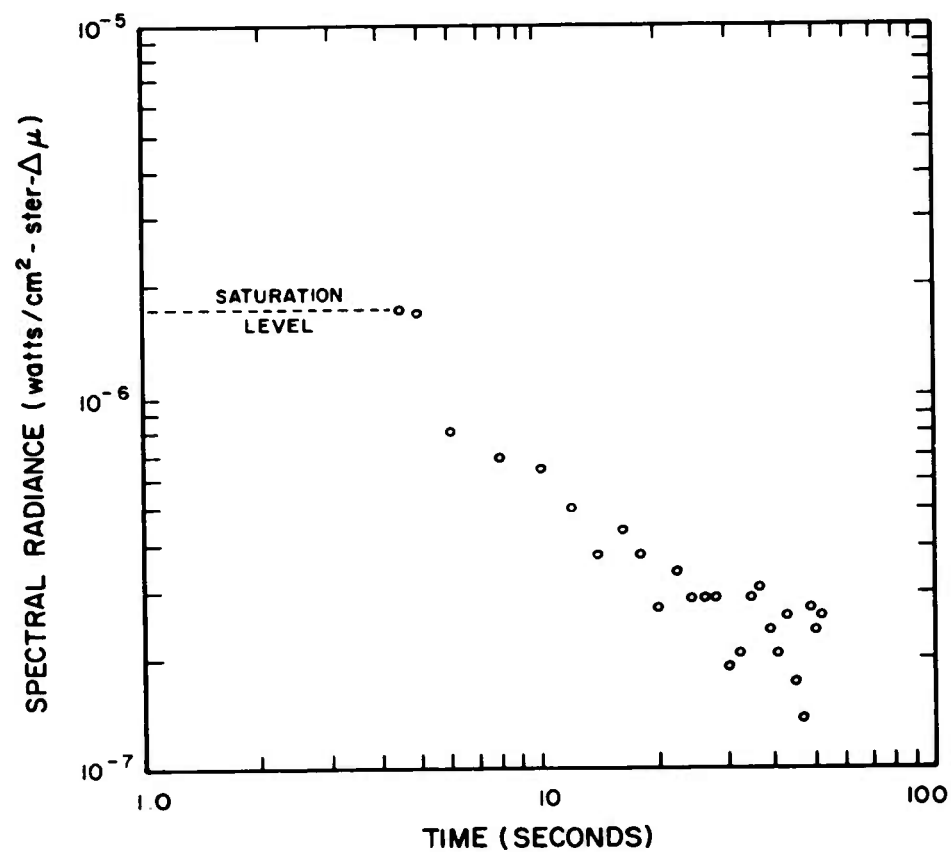


Figure 3.289 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 16, early time.

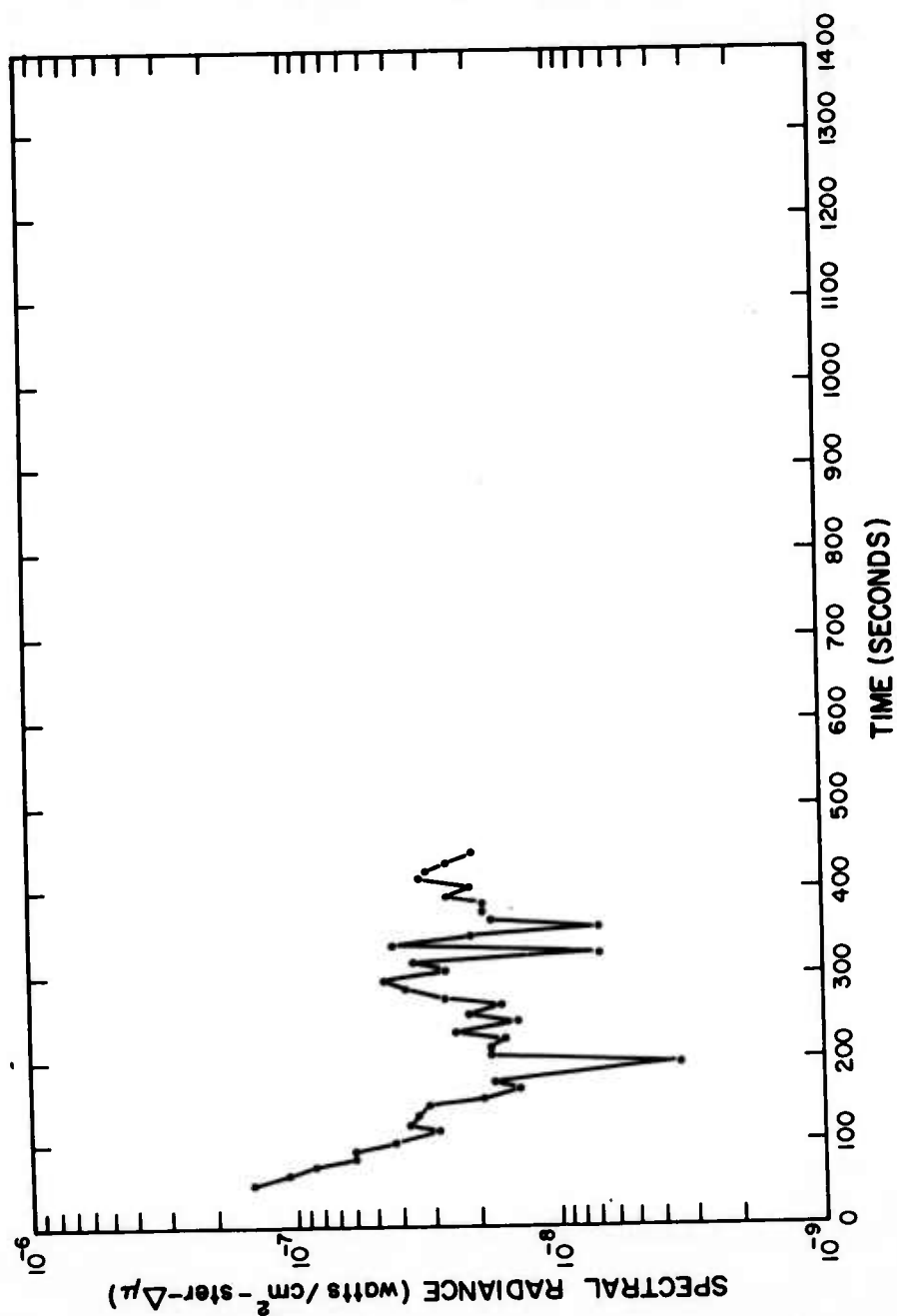


Figure 3.290 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 16, late time.

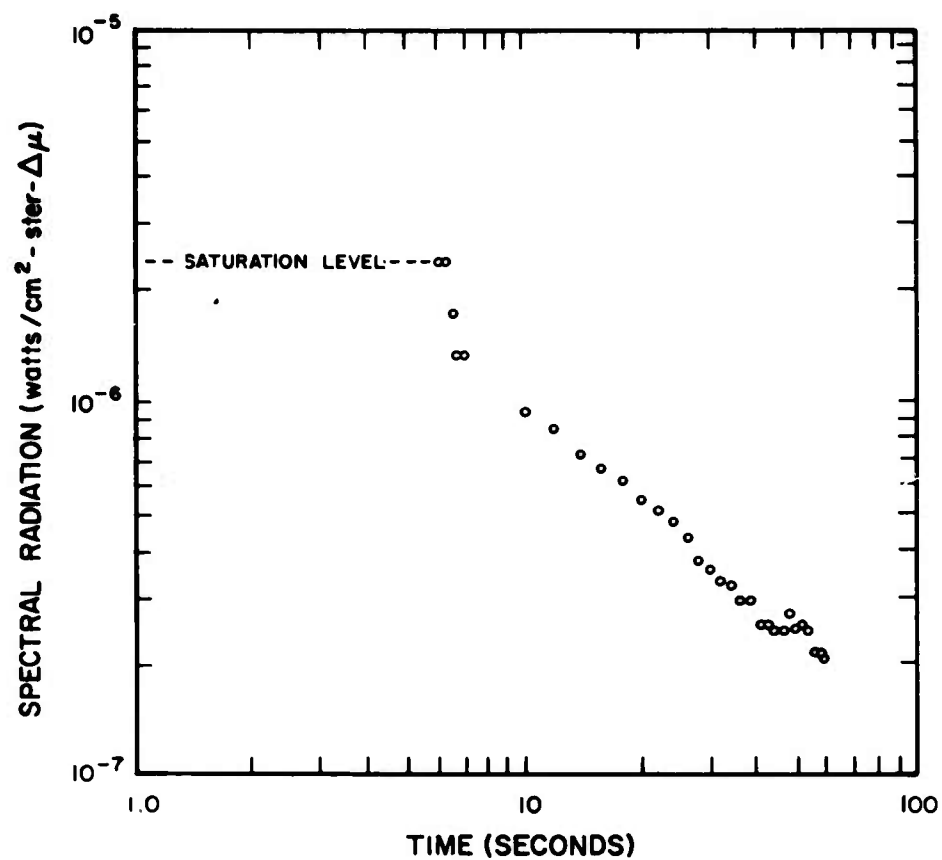


Figure 3.291 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 17, early time.

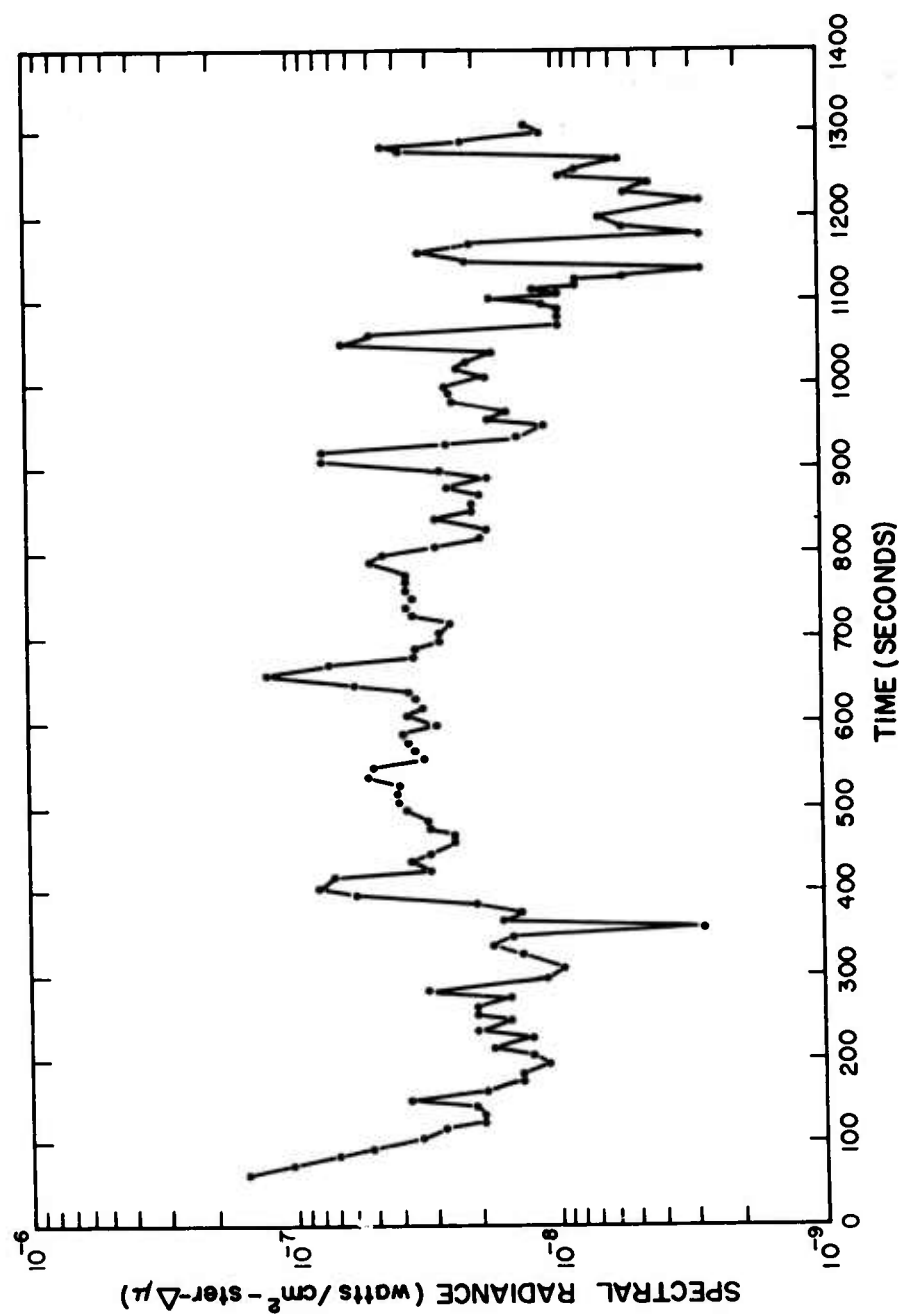


Figure 3.292 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 17, late time.

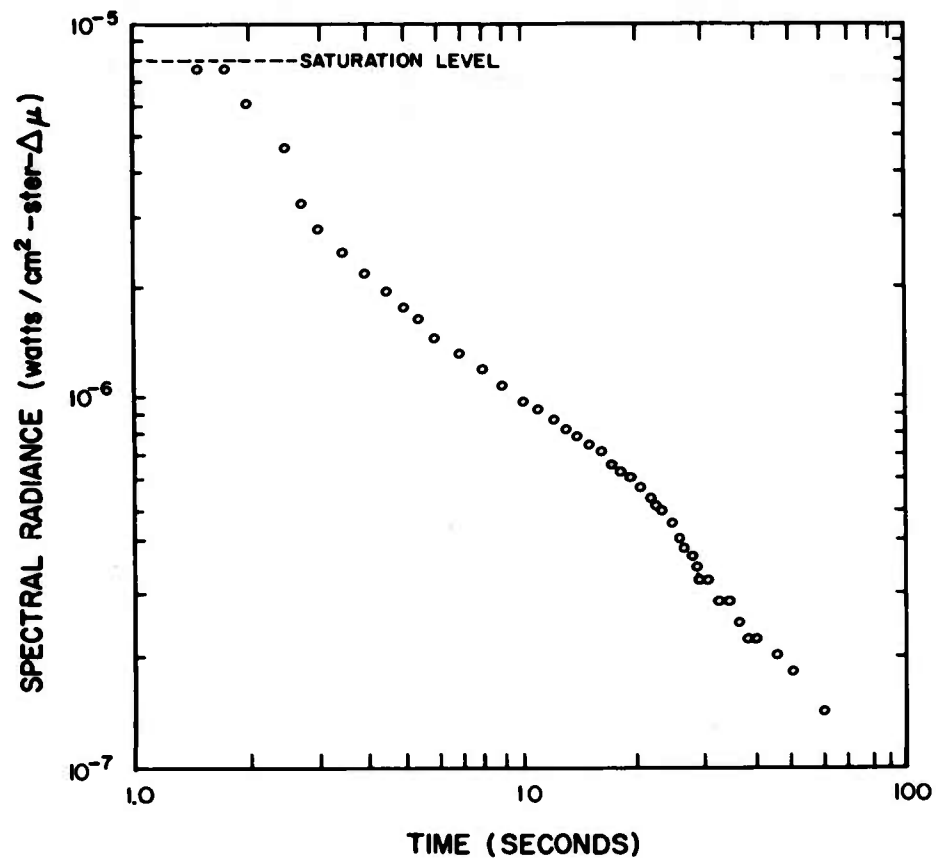


Figure 3.293 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 18, early time.

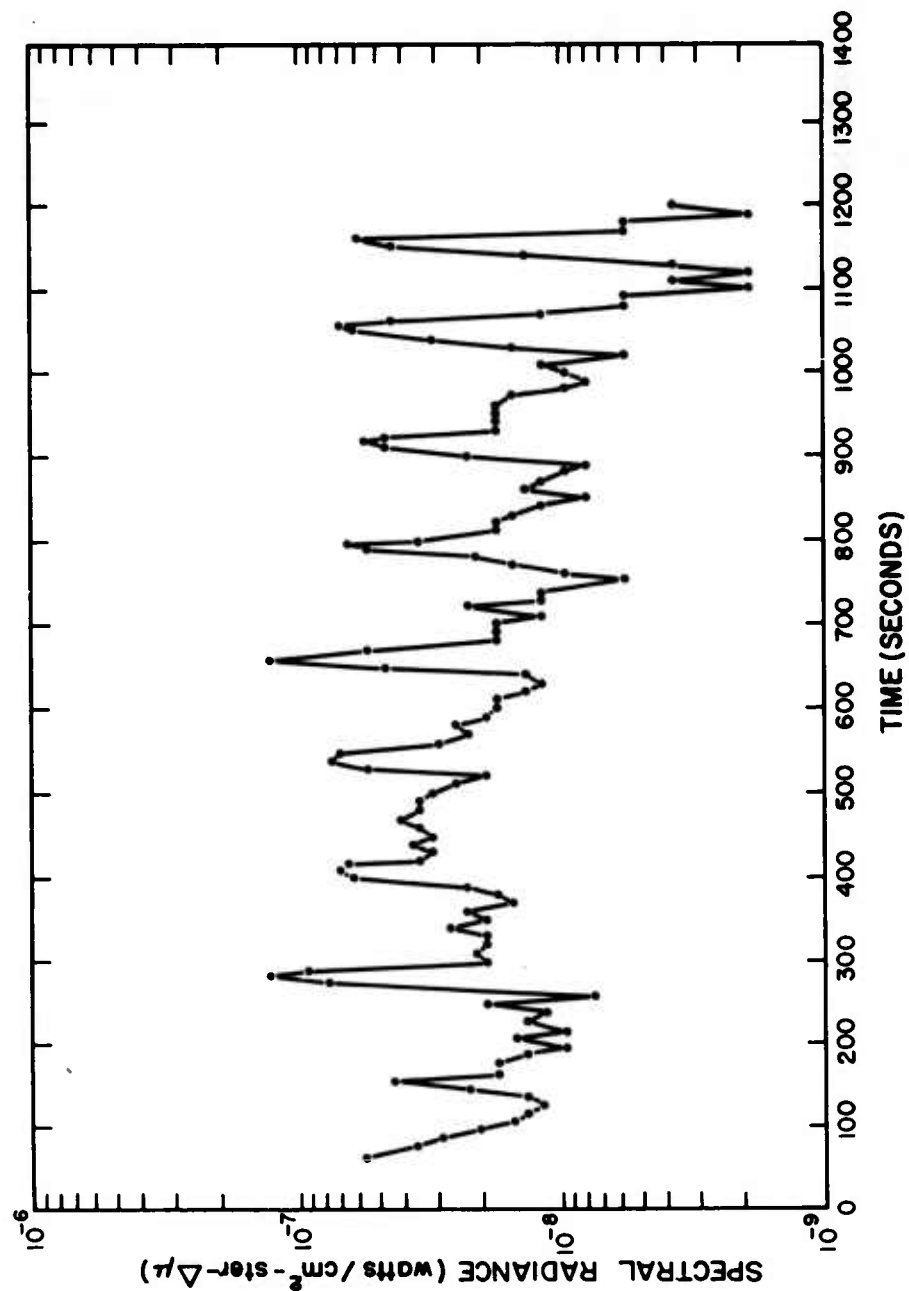


Figure 3.294 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 18, late time.



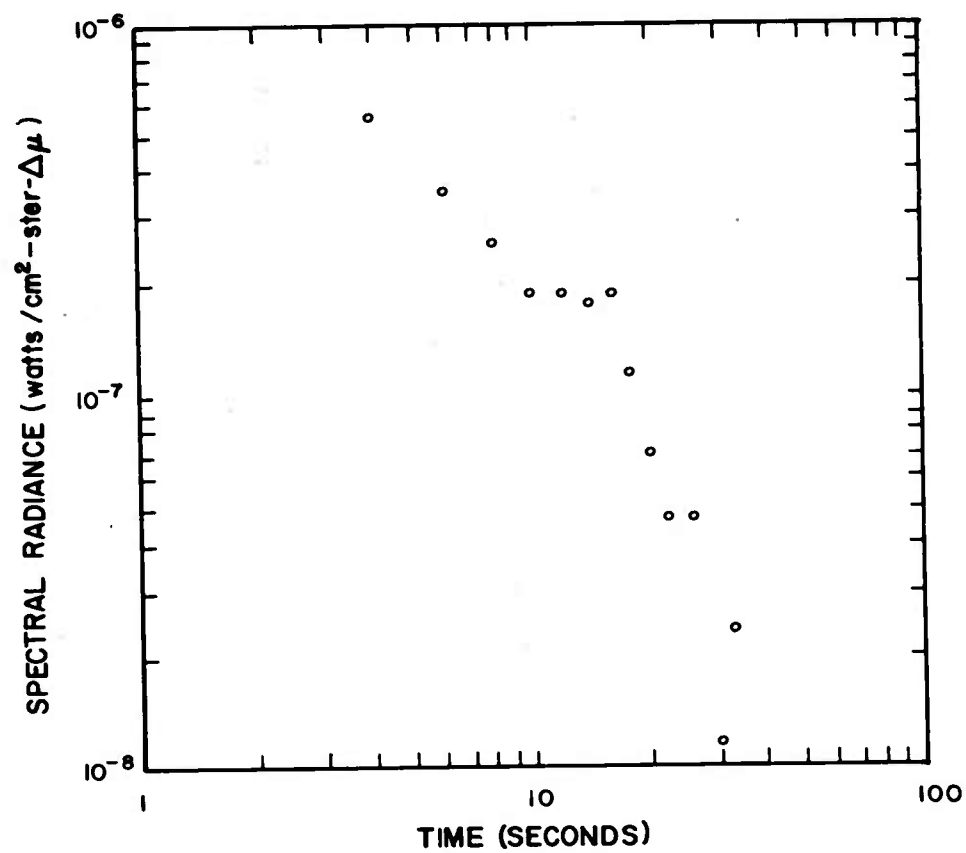


Figure 3.295 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 19.

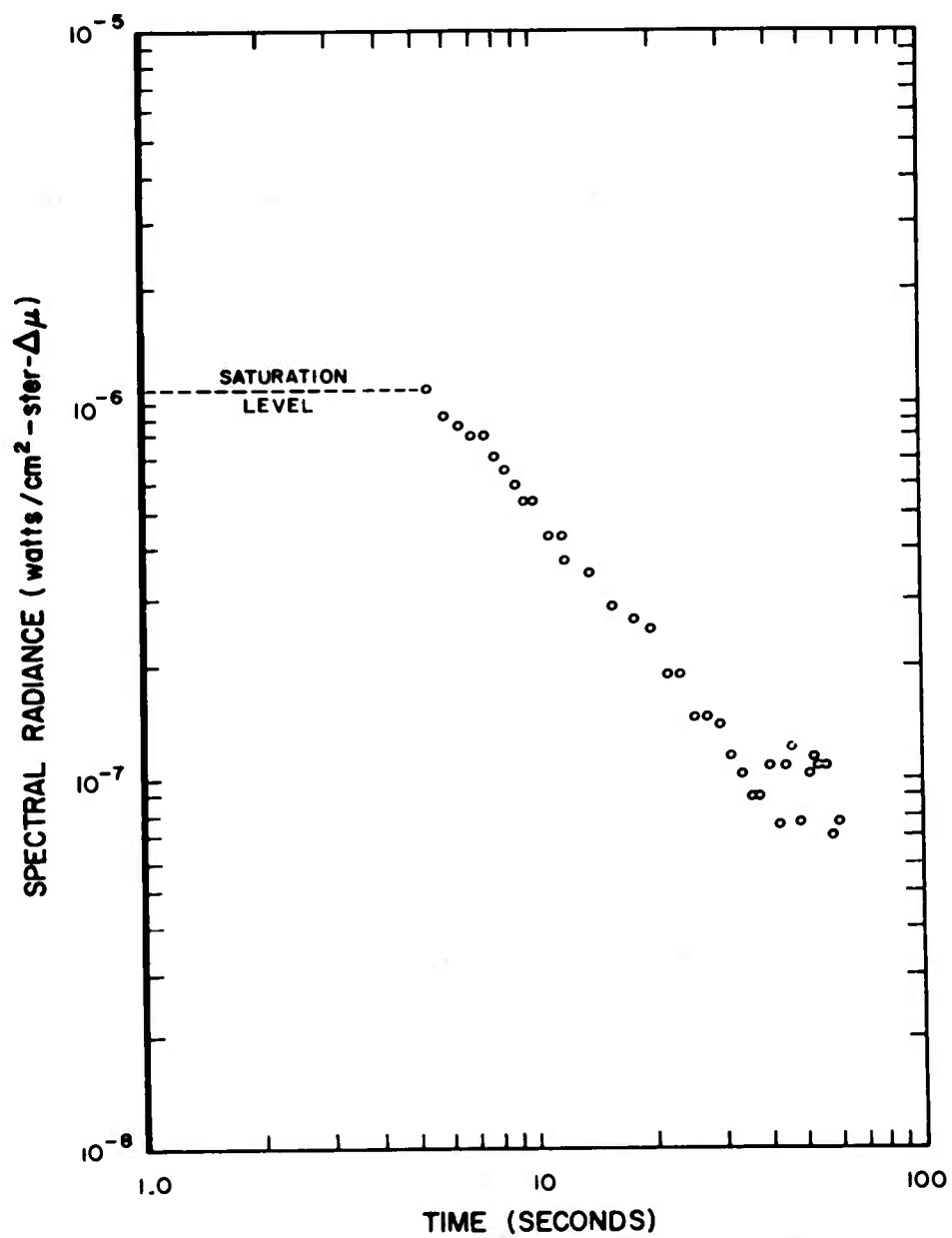


Figure 3.296 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 20.

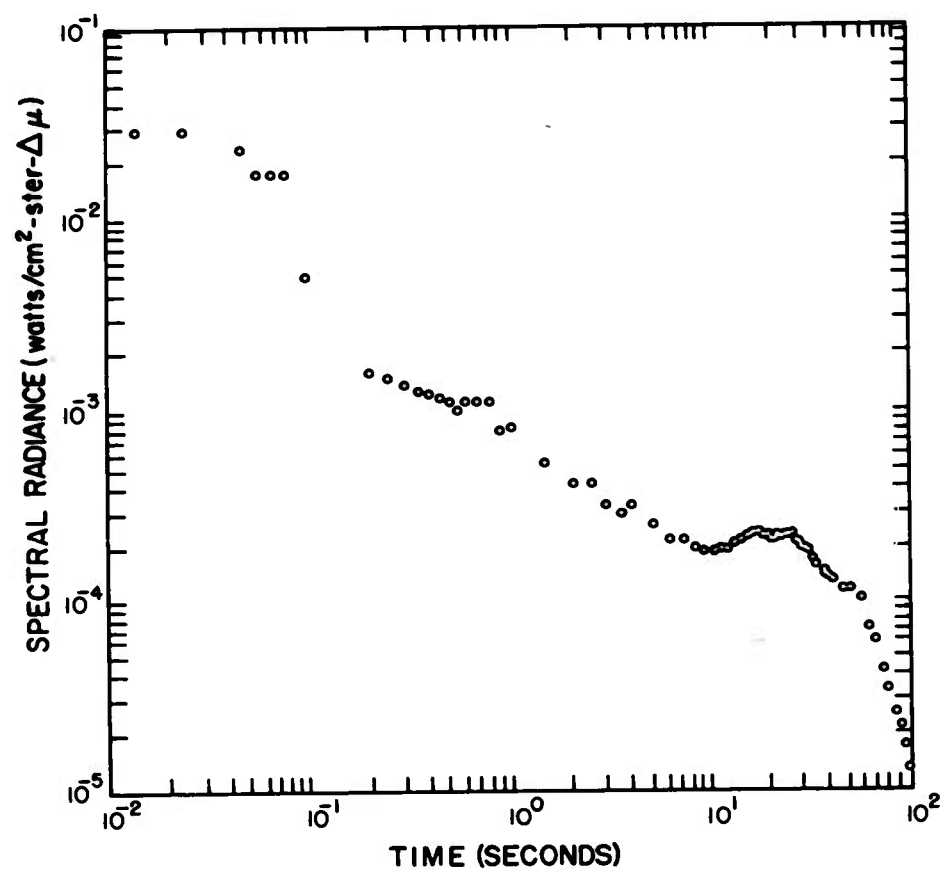


Figure 3.297 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 21, early time.

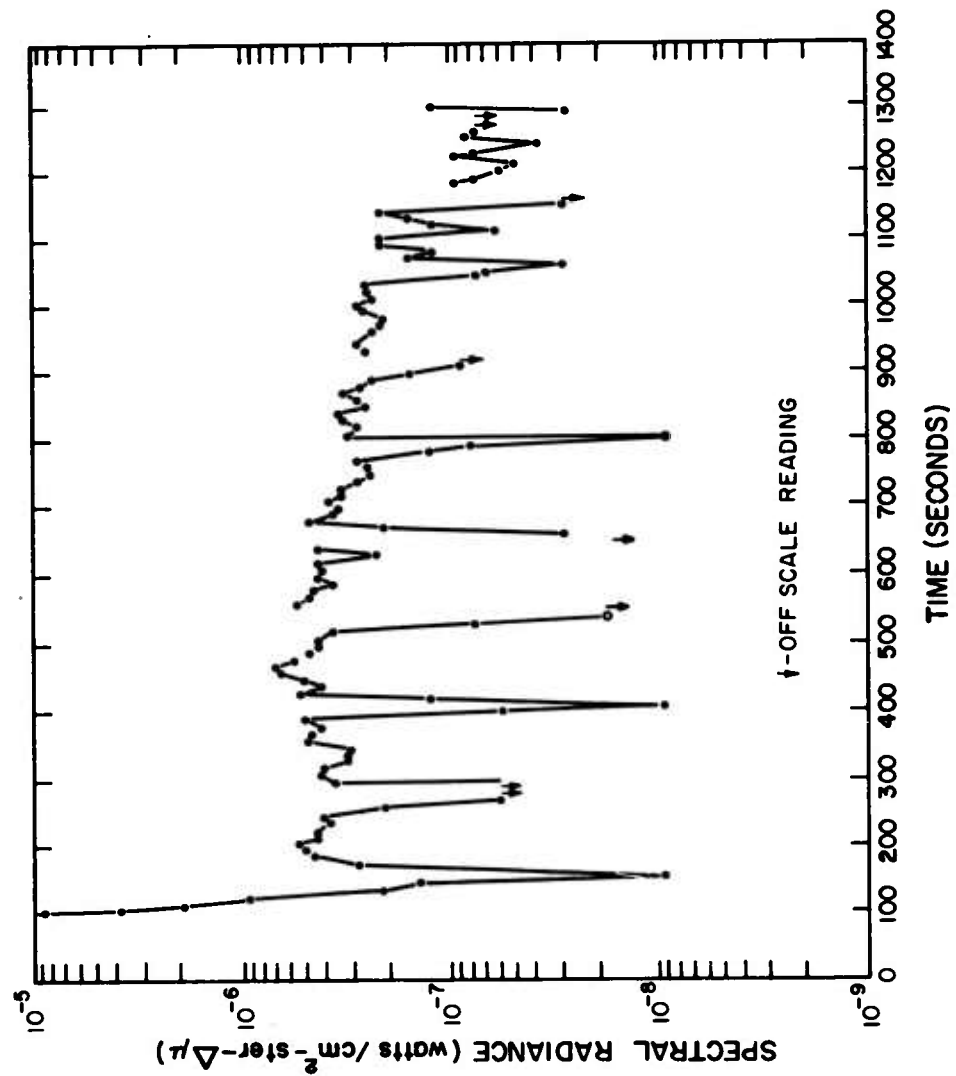


Figure 3.298 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 21, late time.

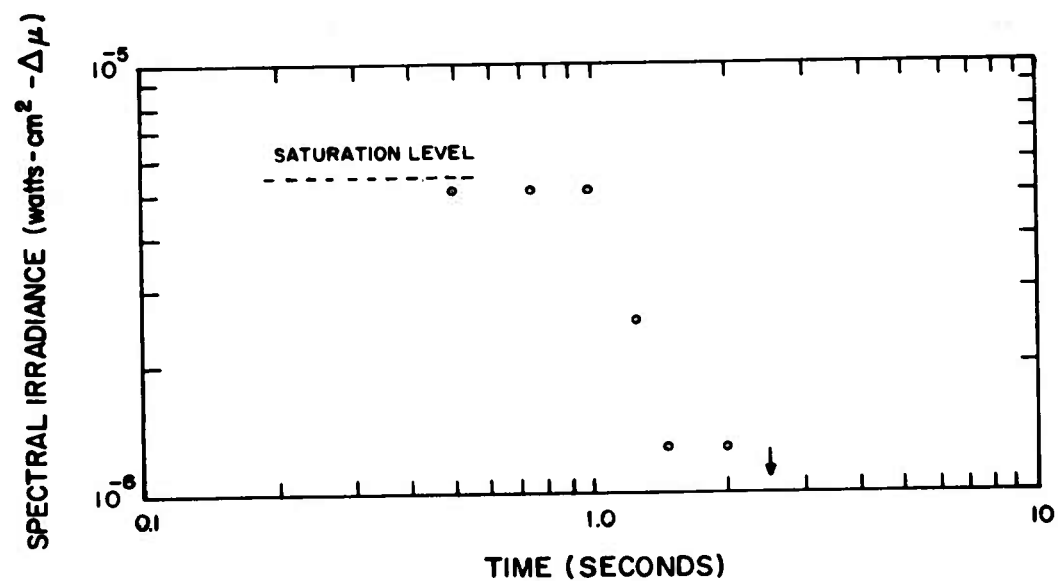


Figure 3.299 Spectral radiance, Kettle I, Blue Gill Triple Prime, Channel 22.

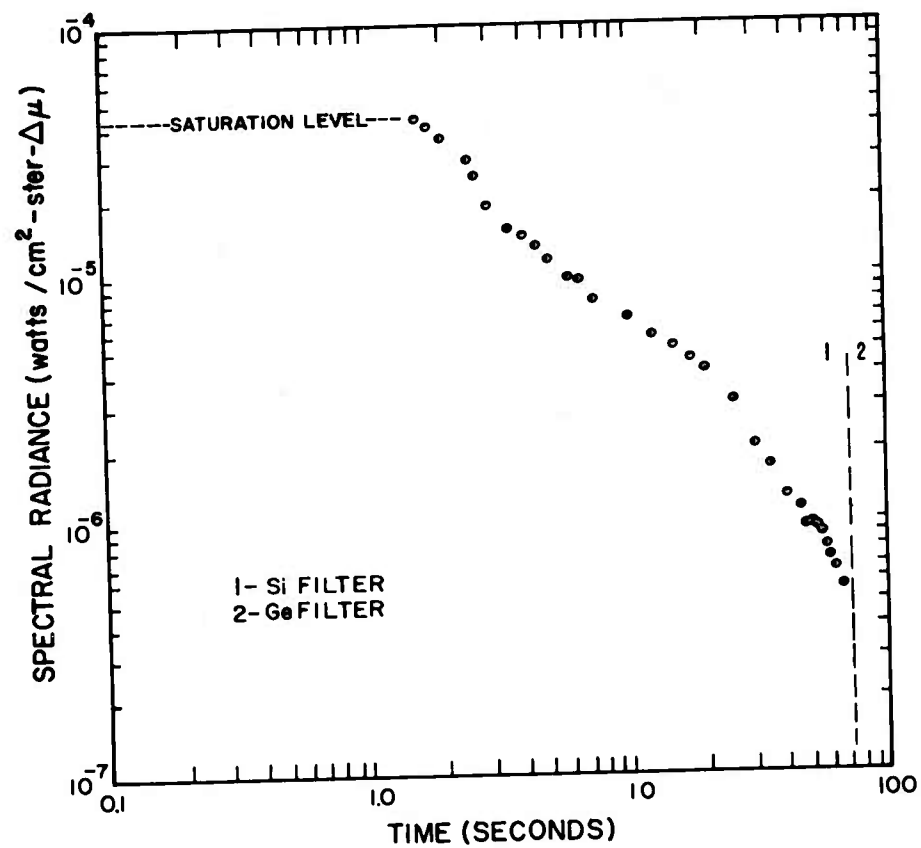


Figure 3.300 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 1, early time.

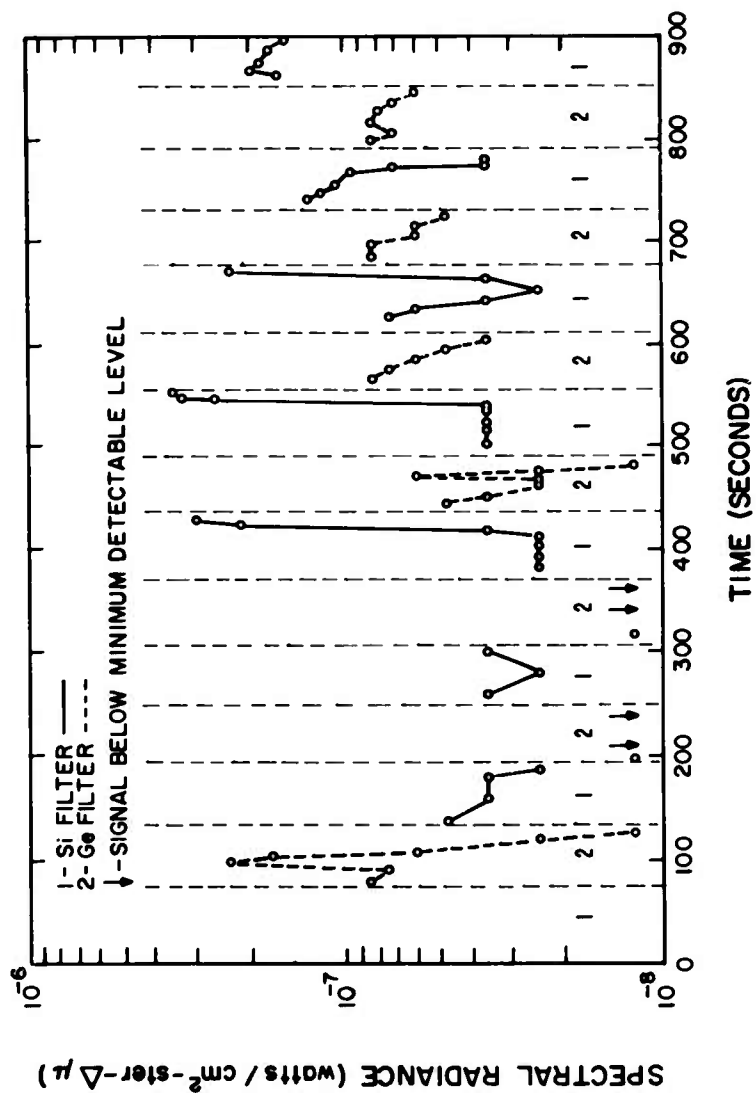


Figure 3.301 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 1, late time.

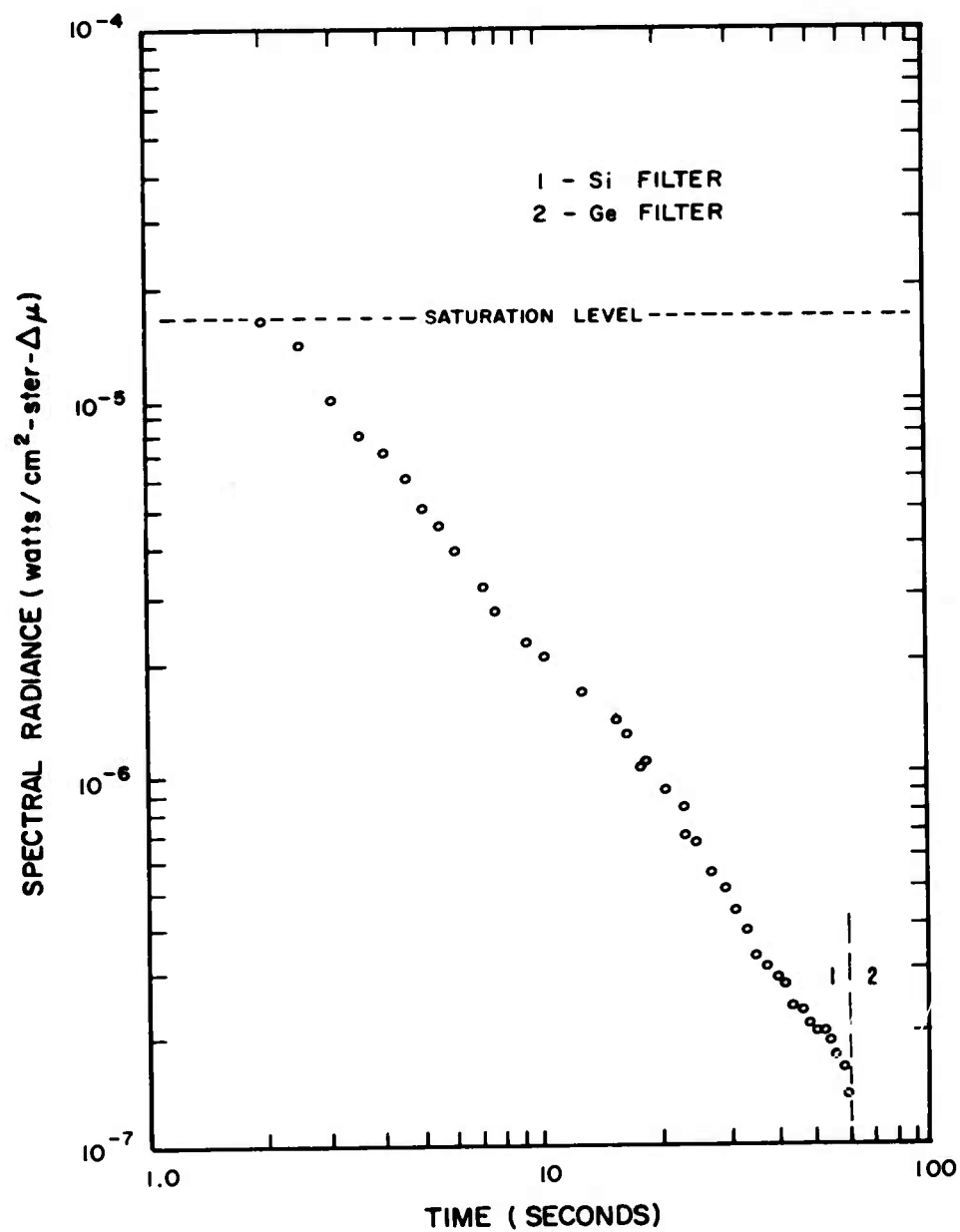


Figure 3.302 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 2, early time.



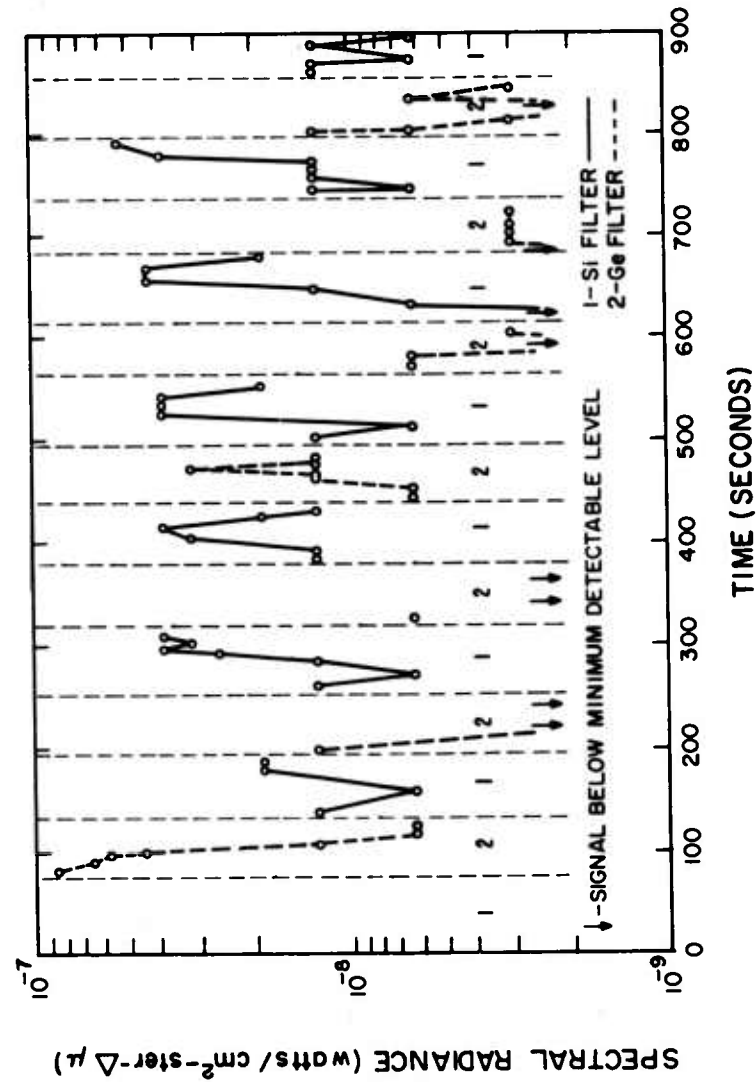


Figure 3.303 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 2, late time.

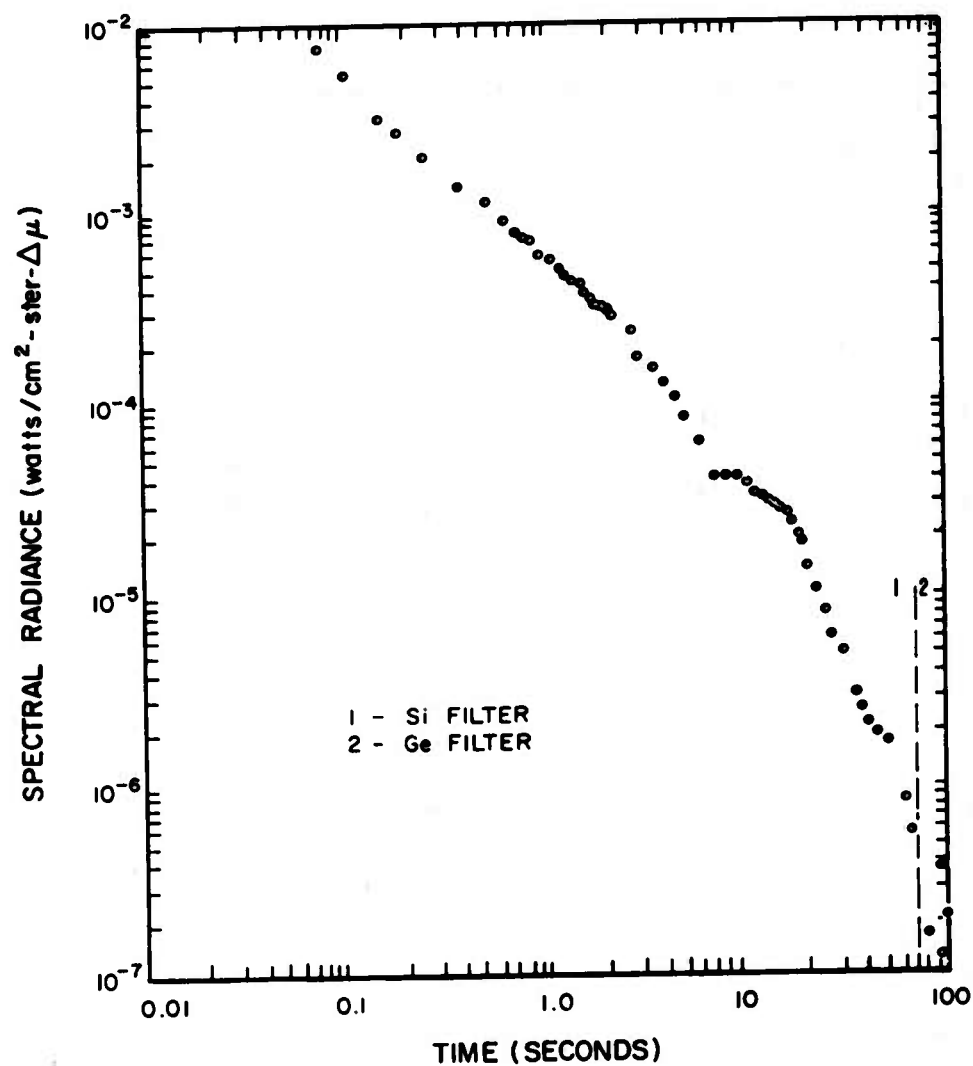


Figure 3.304 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 3, early time.

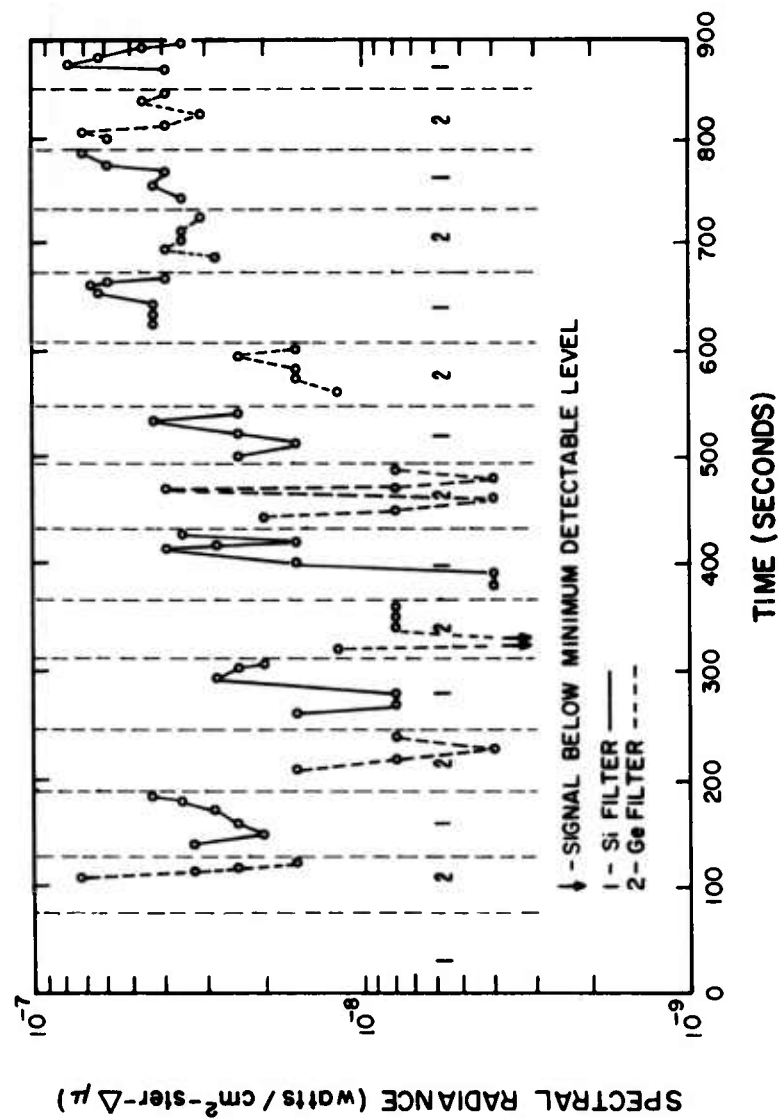


Figure 3.305 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 3, late time.

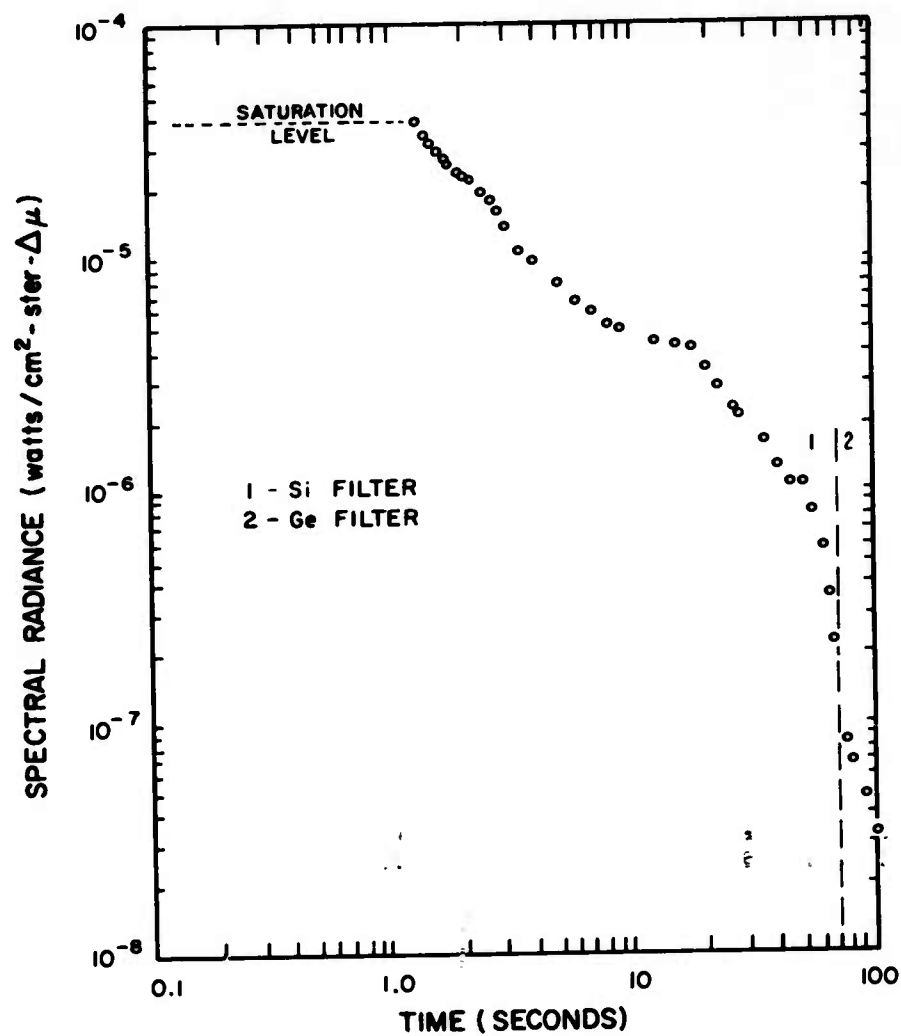


Figure 3.306 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 4, early time.

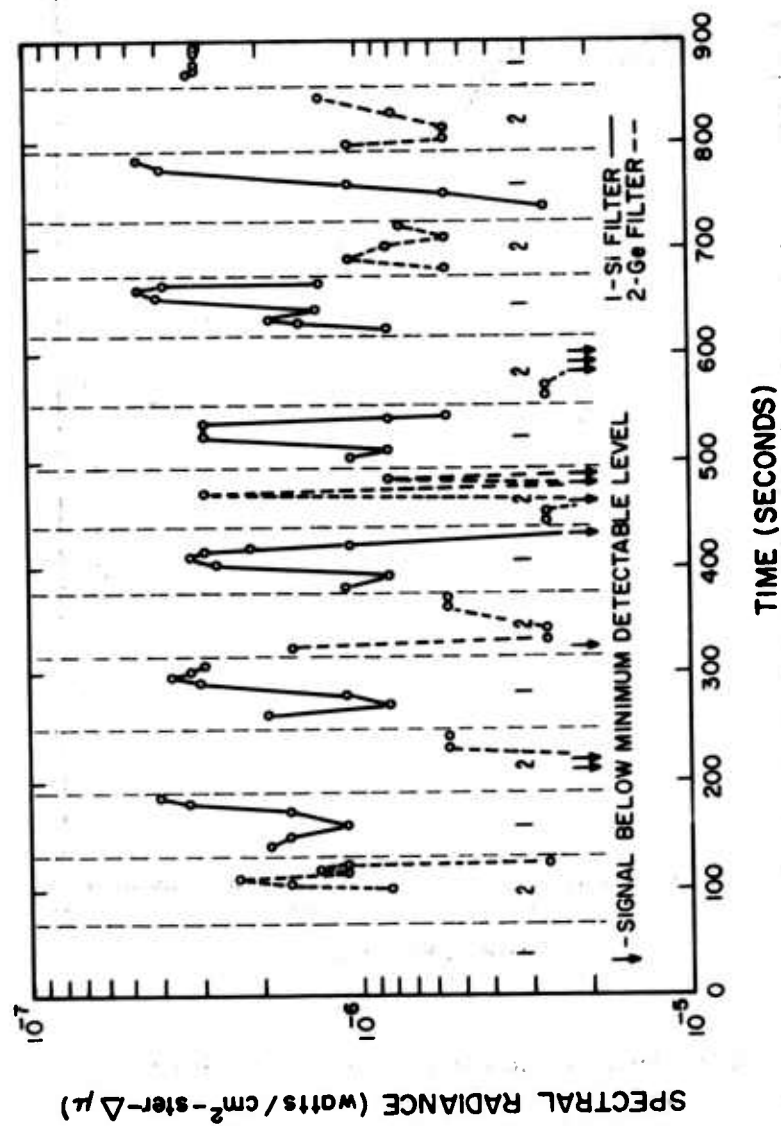


Figure 3.307 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 4, late time.

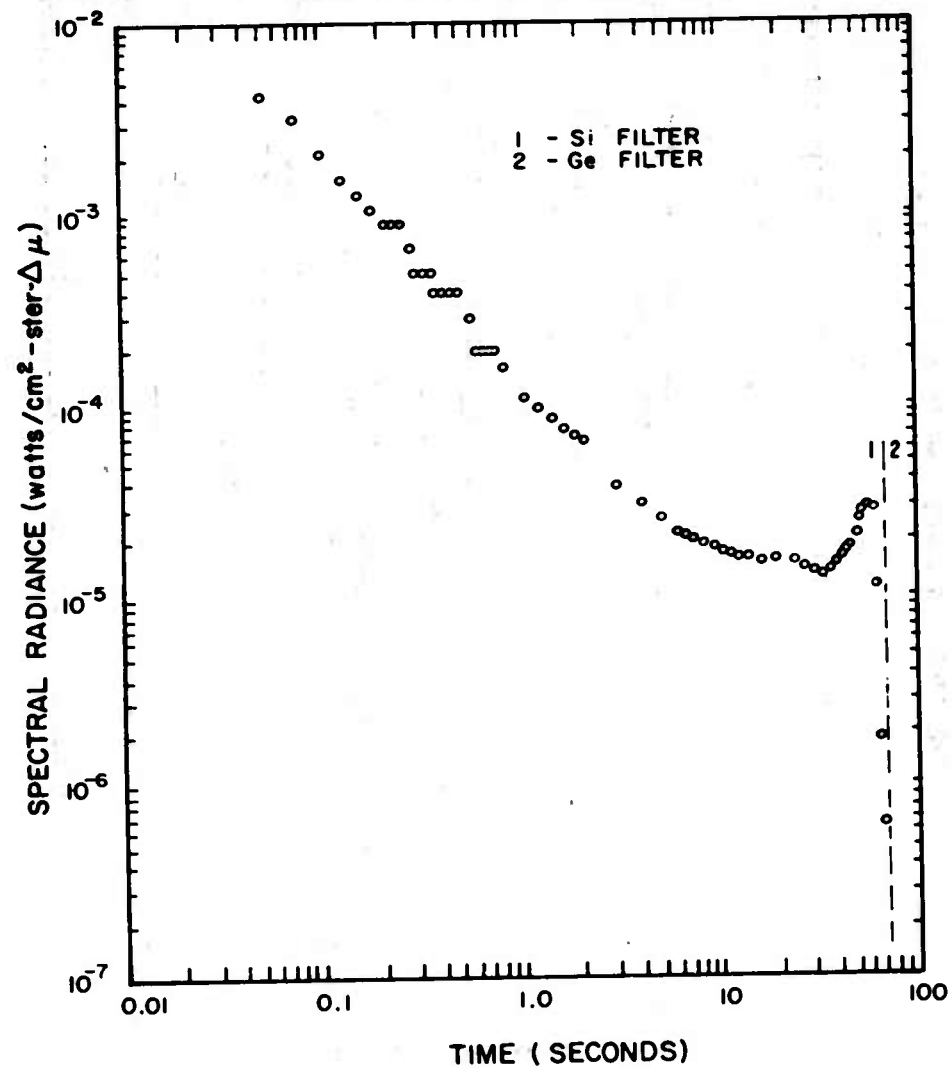


Figure 3.308 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 5, early time.

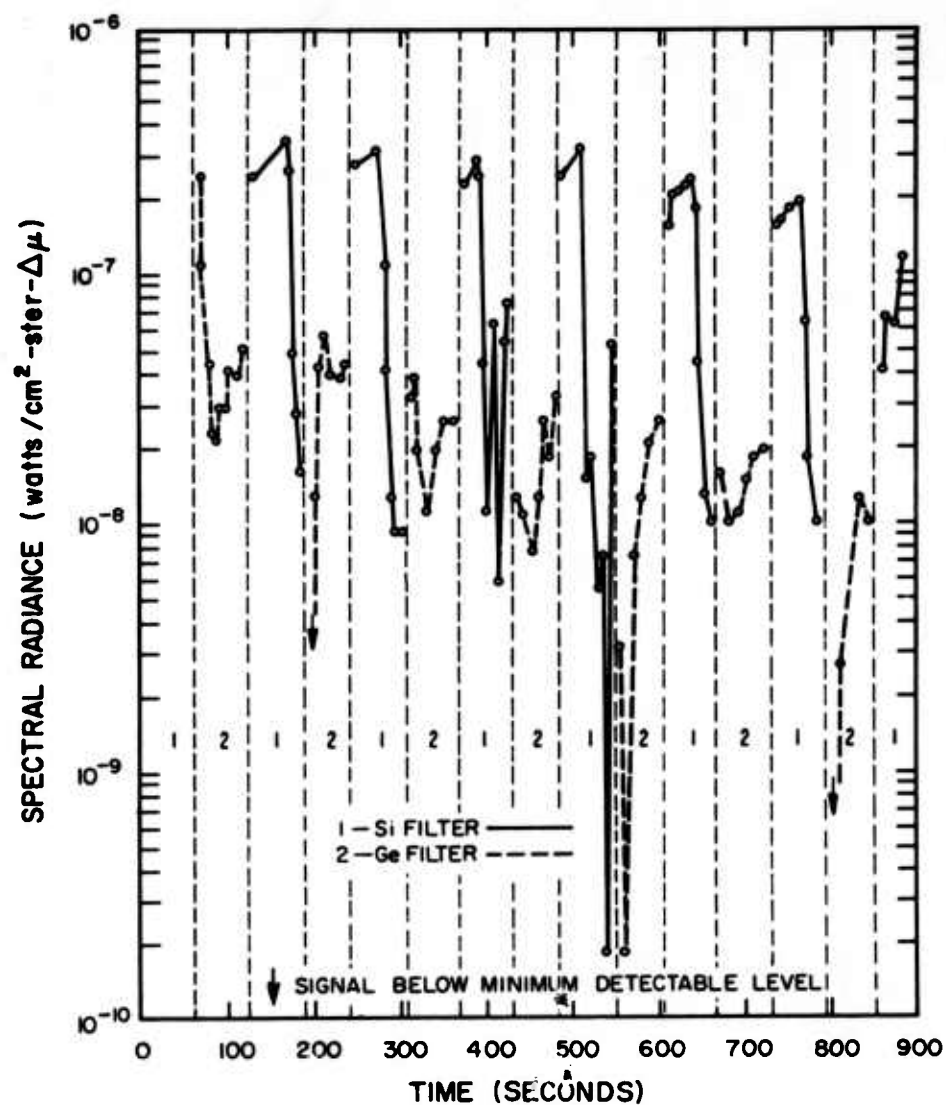


Figure 3.309 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 5, late time.

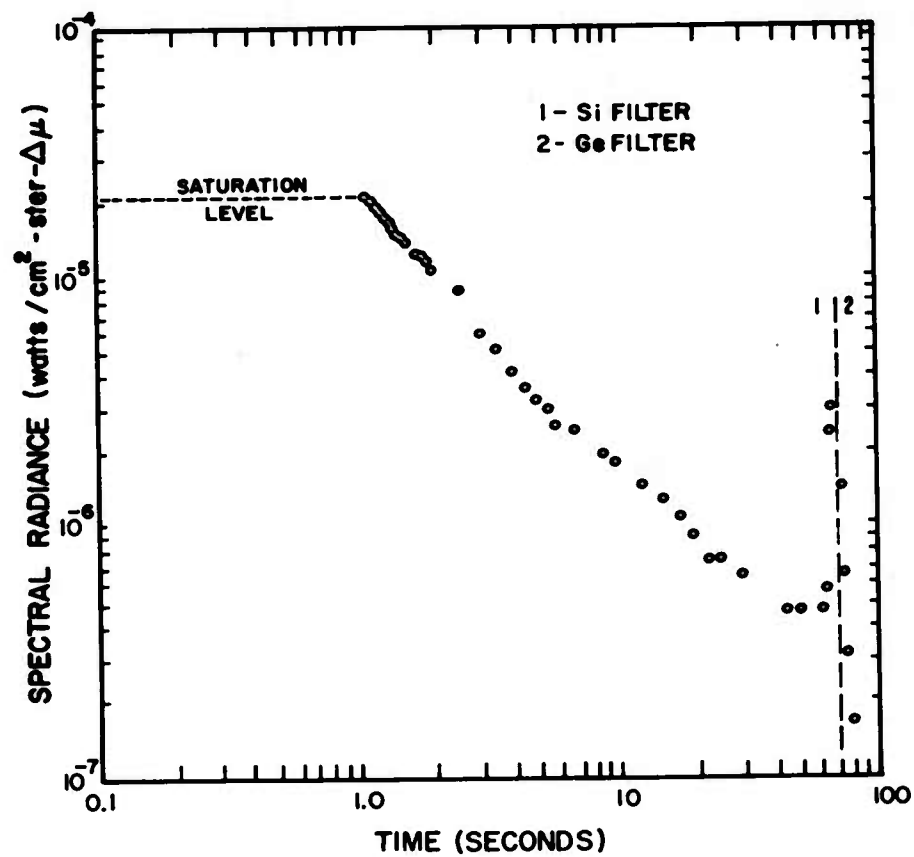


Figure 3.310 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 6, early time.



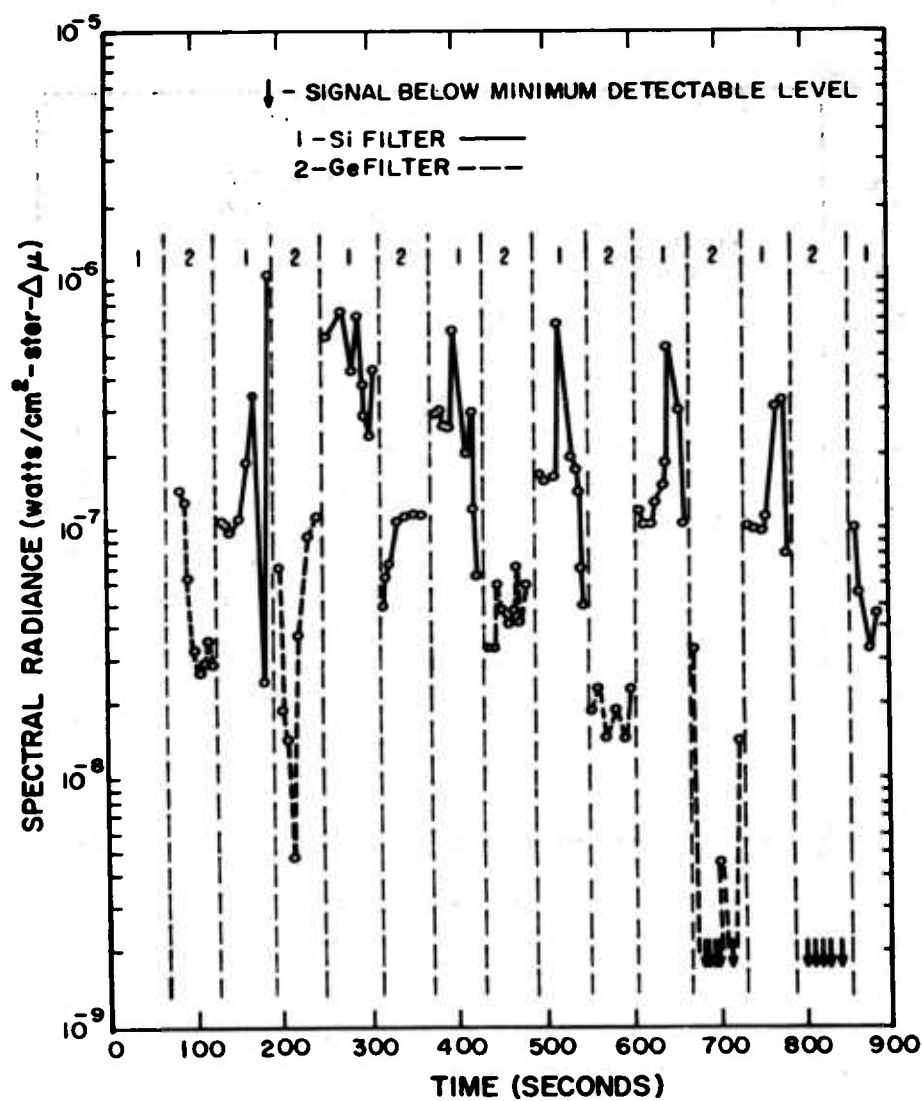


Figure 3.311 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 6, late time.

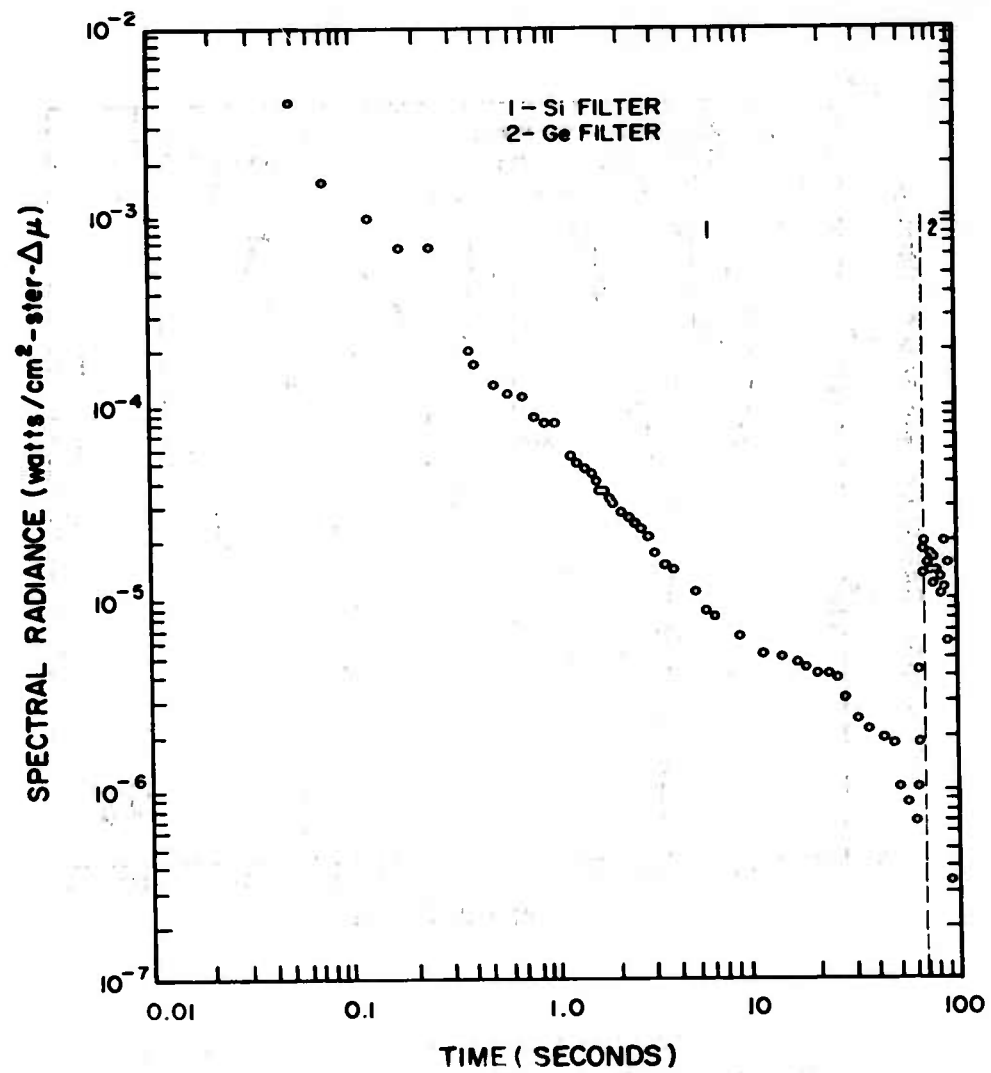


Figure 3.312 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 7, early time.

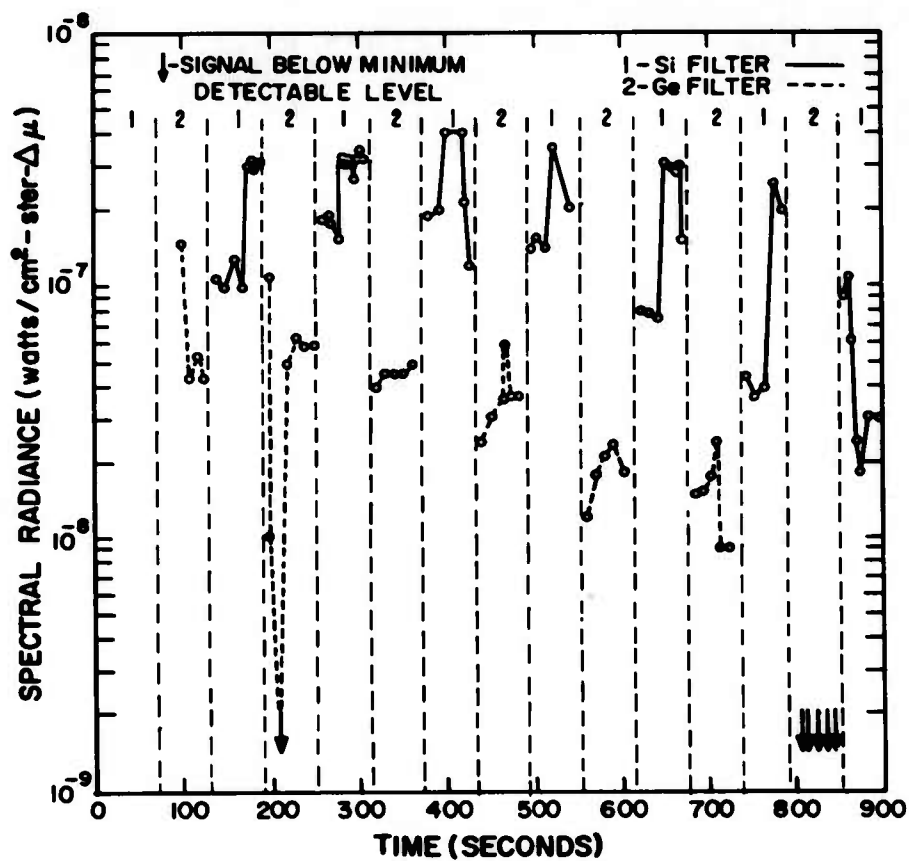


Figure 3.13 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 7, late time.

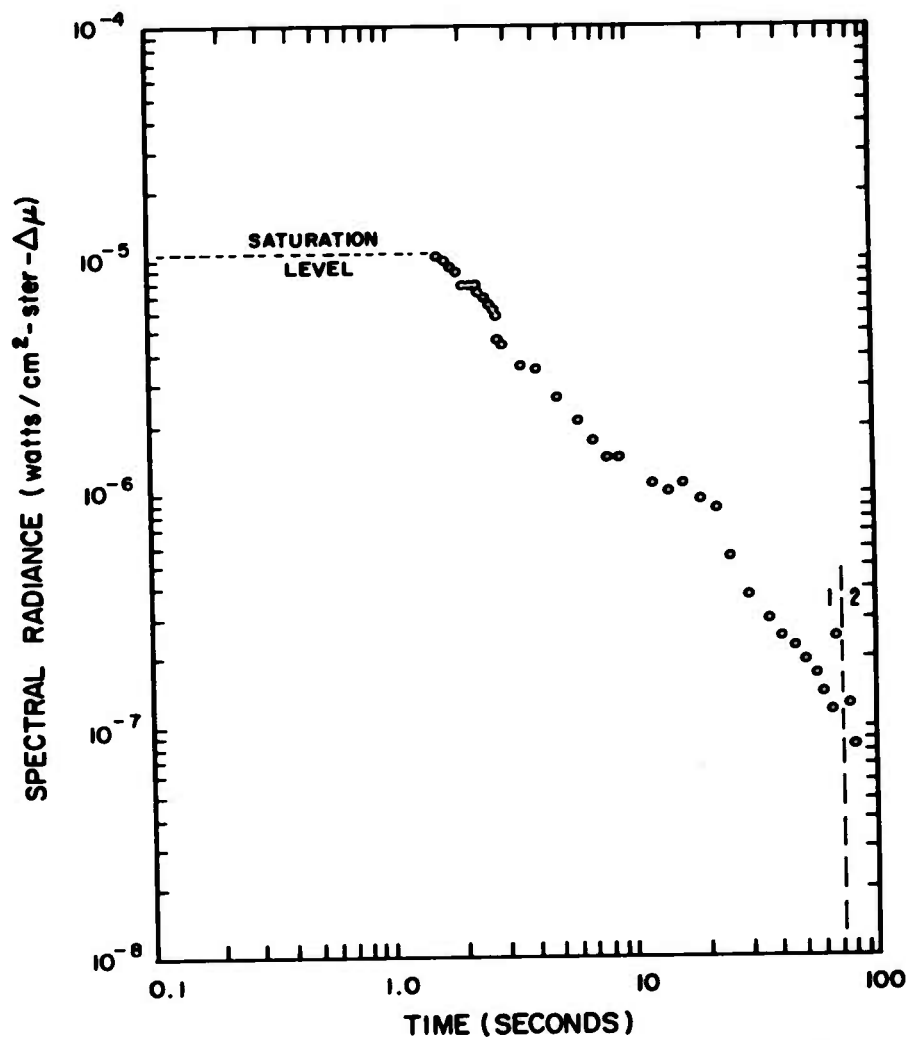


Figure 3.314 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 8, early time.

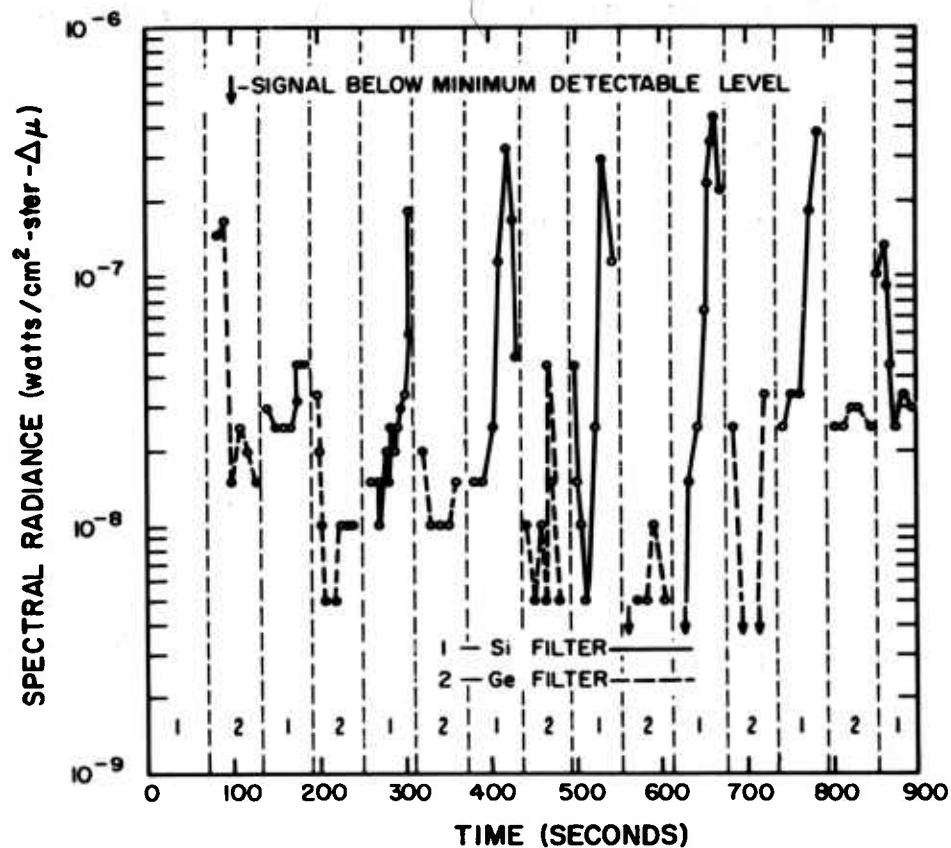


Figure 3.315 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 8, late time.

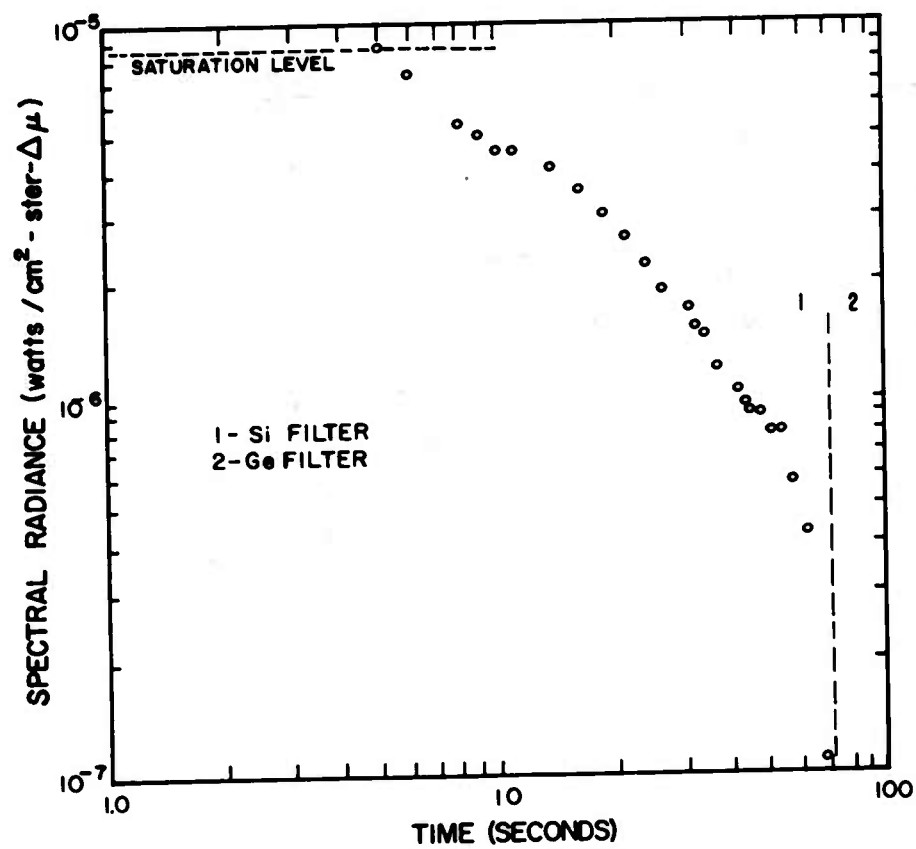


Figure 3.316 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 9, early time.

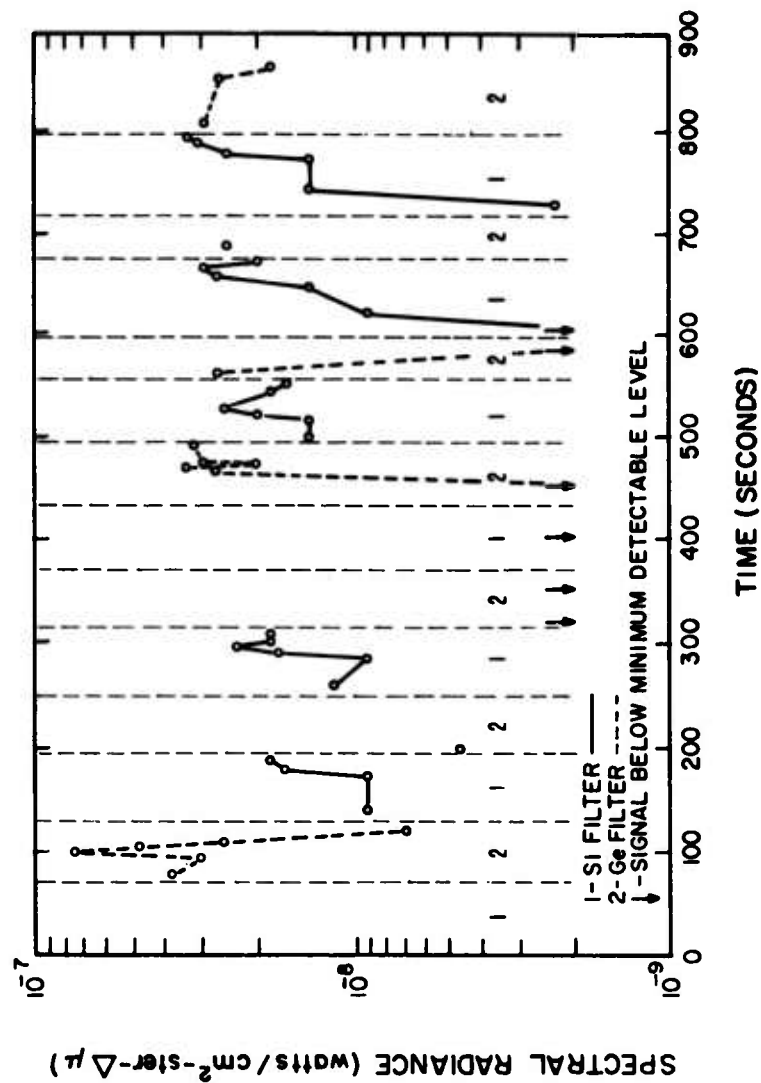


Figure 3.317 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 9, late time.

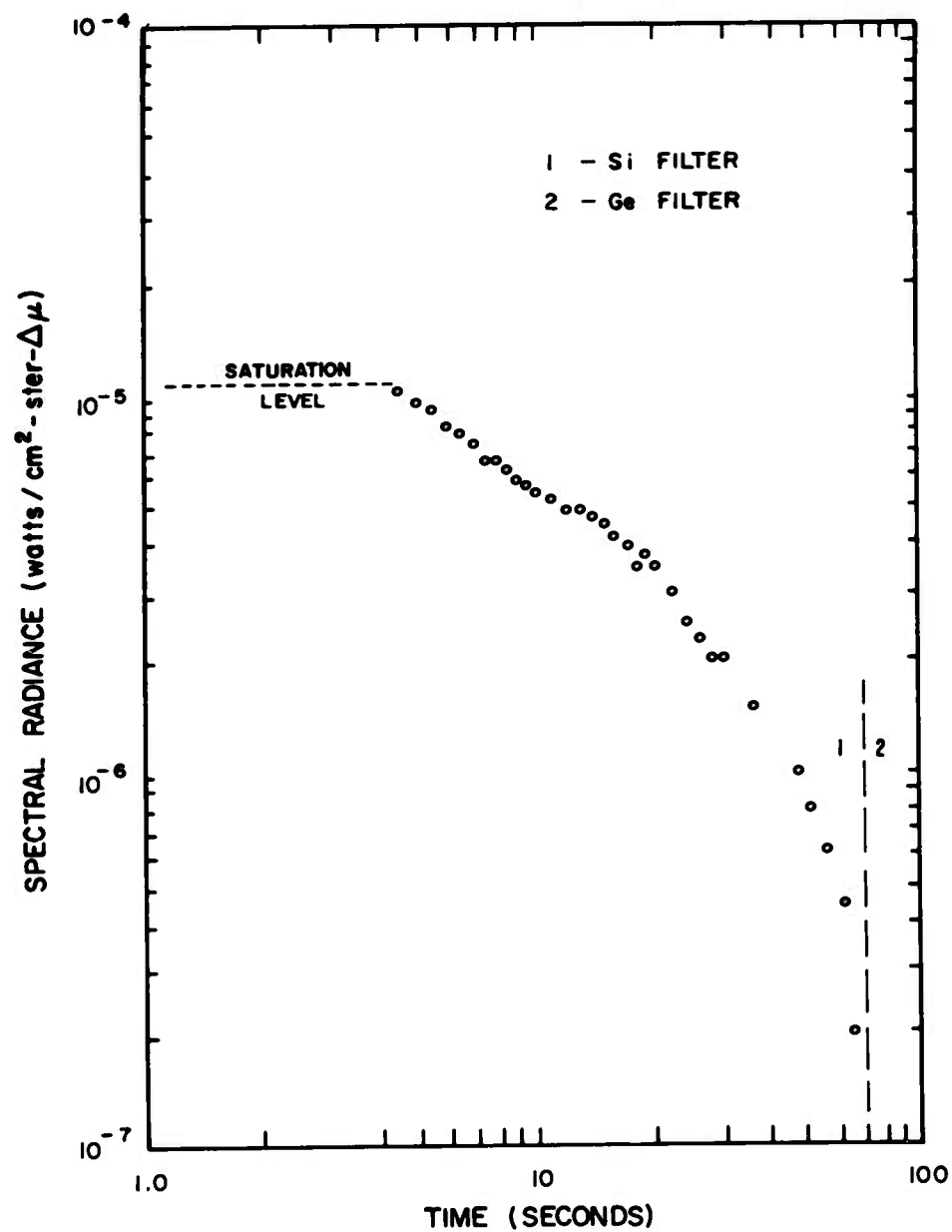


Figure 3.318 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 14, early time.



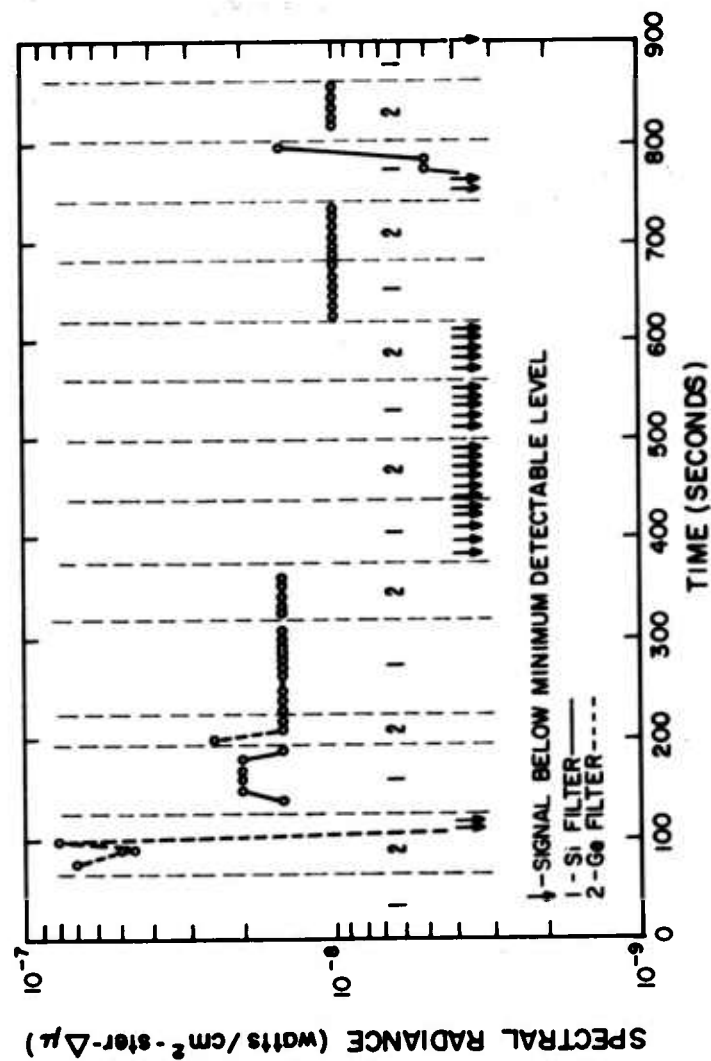


Figure 3.319 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 14, late time.

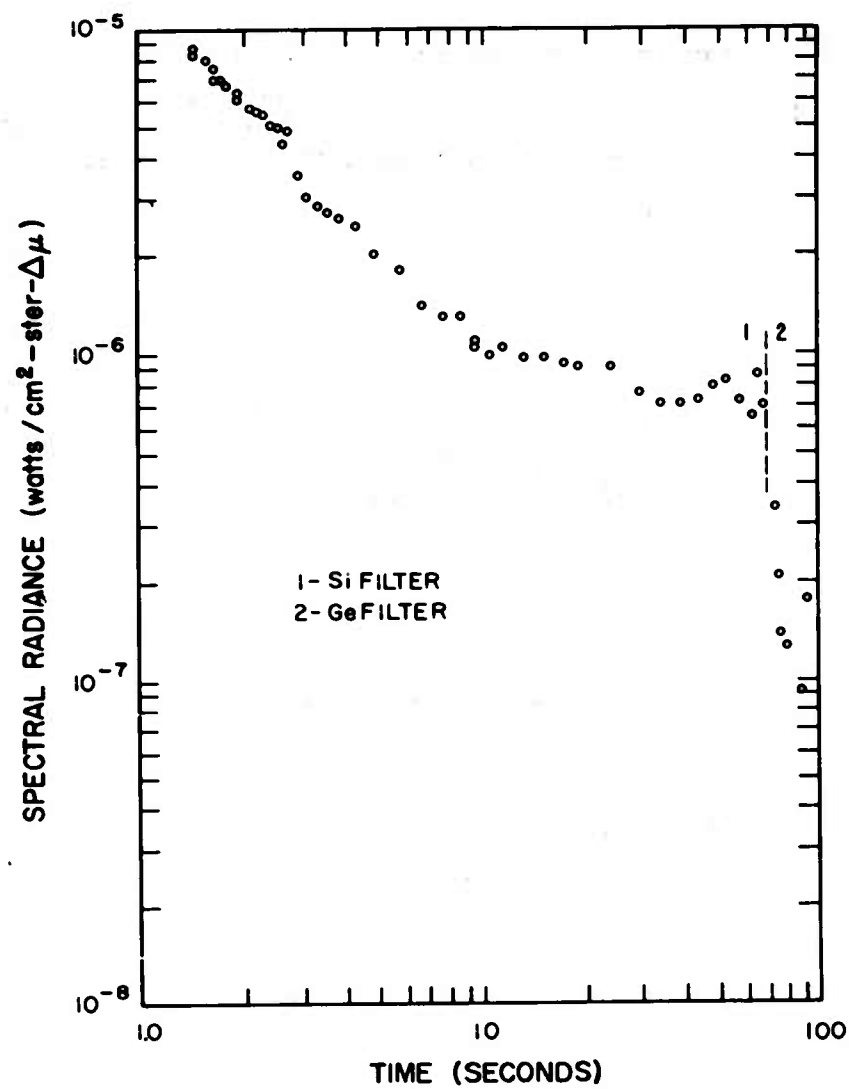


Figure 3.320 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 15, early time.

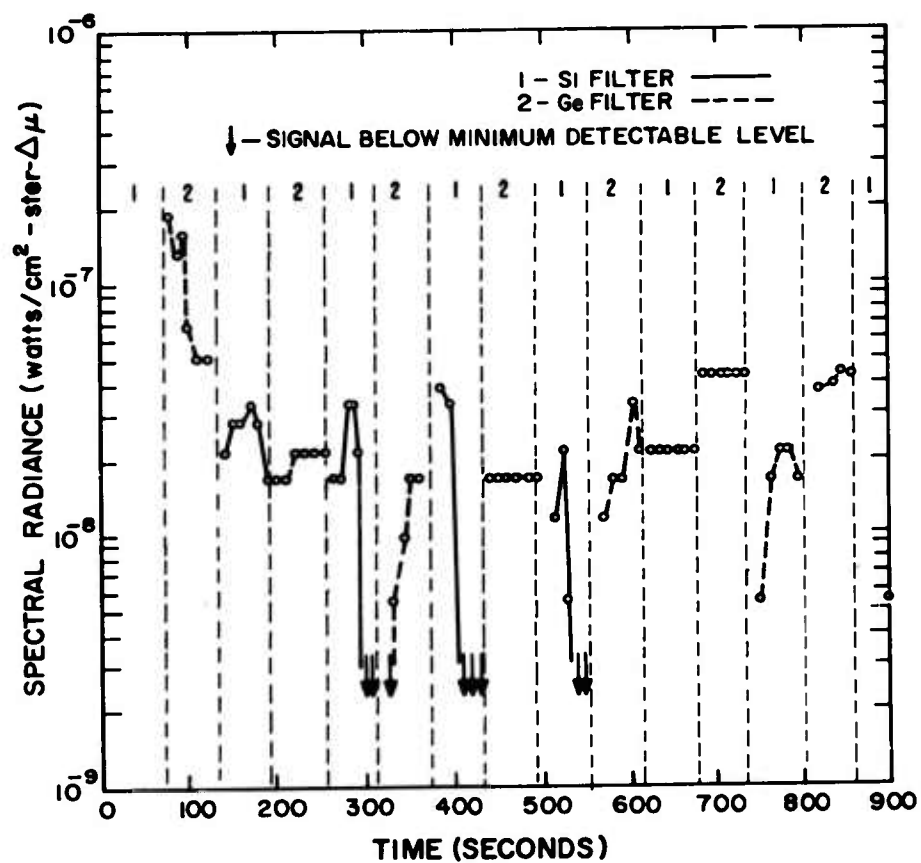


Figure 3.321 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 15, late time.

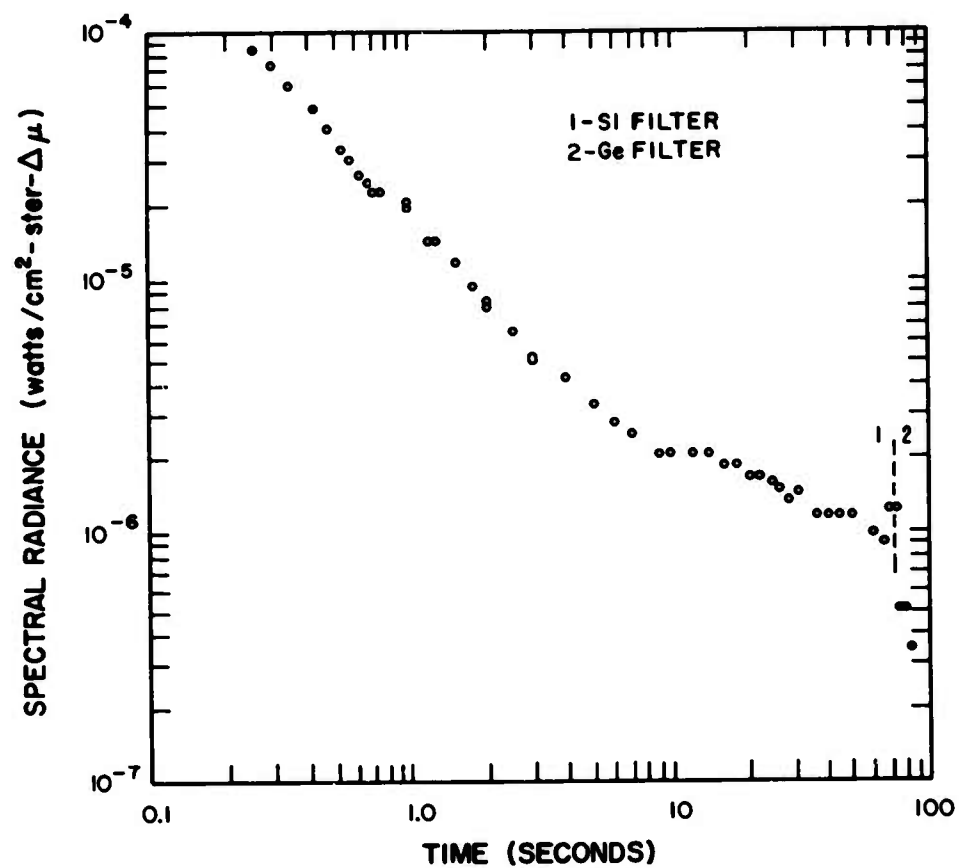


Figure 3.322 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 16, early time.

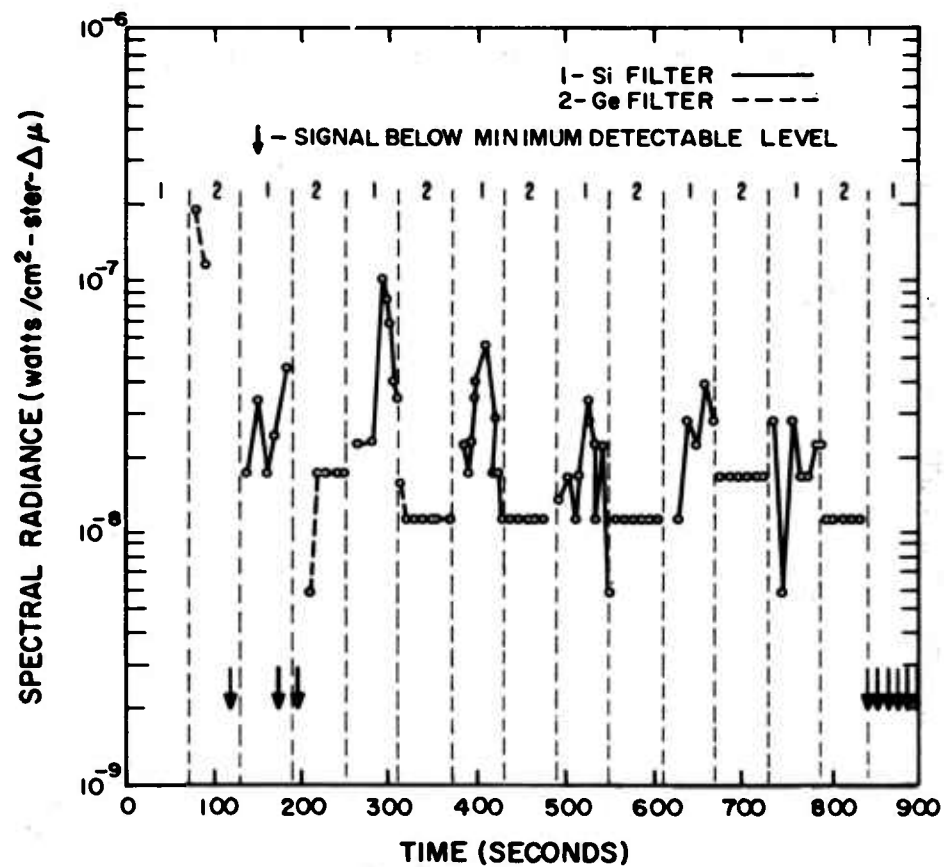


Figure 3.323 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 16, late time.

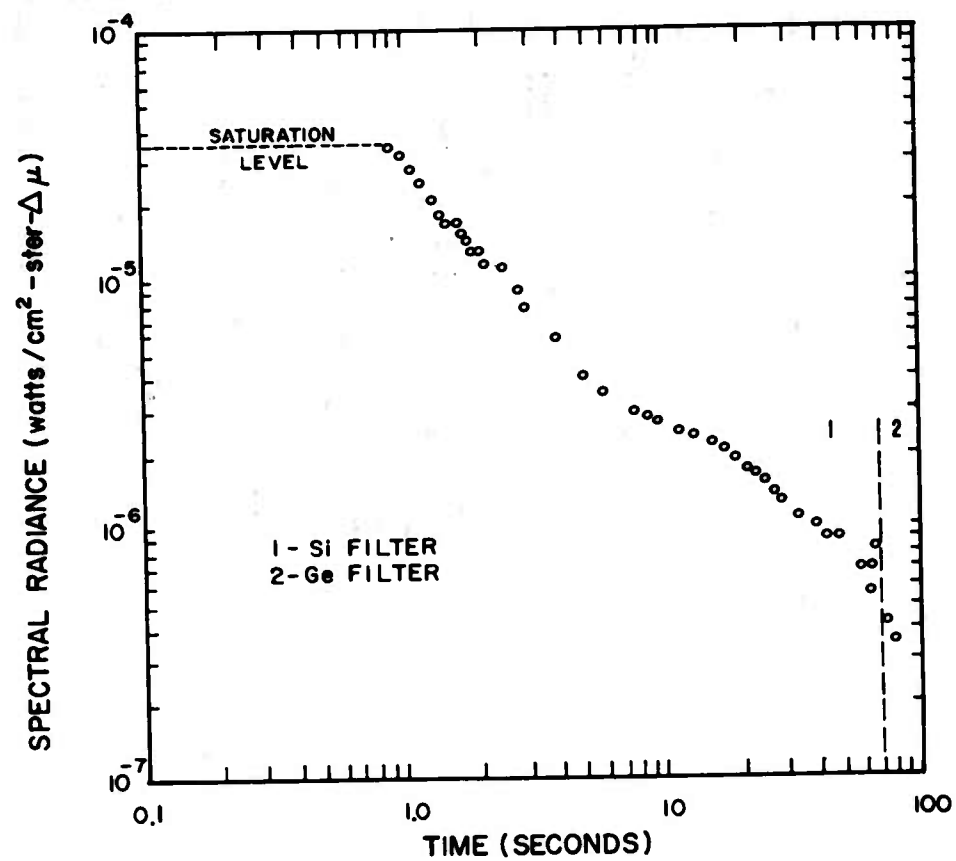


Figure 3.324 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 17, early time.

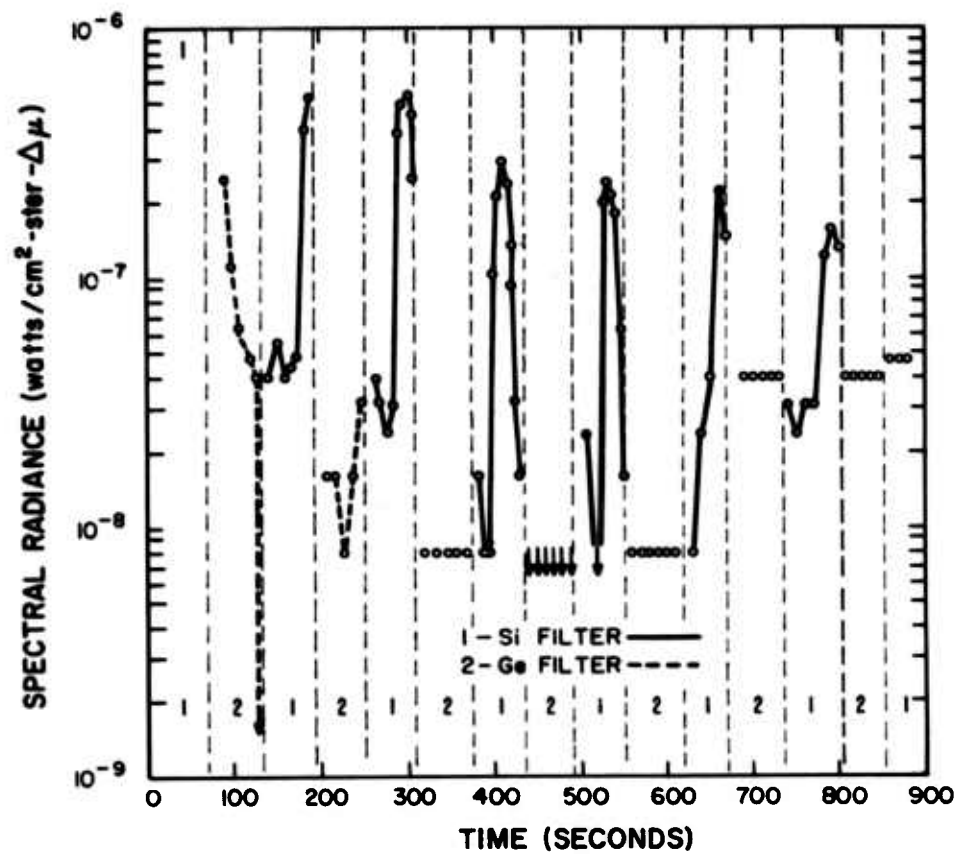


Figure 3.325 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 17, late time.

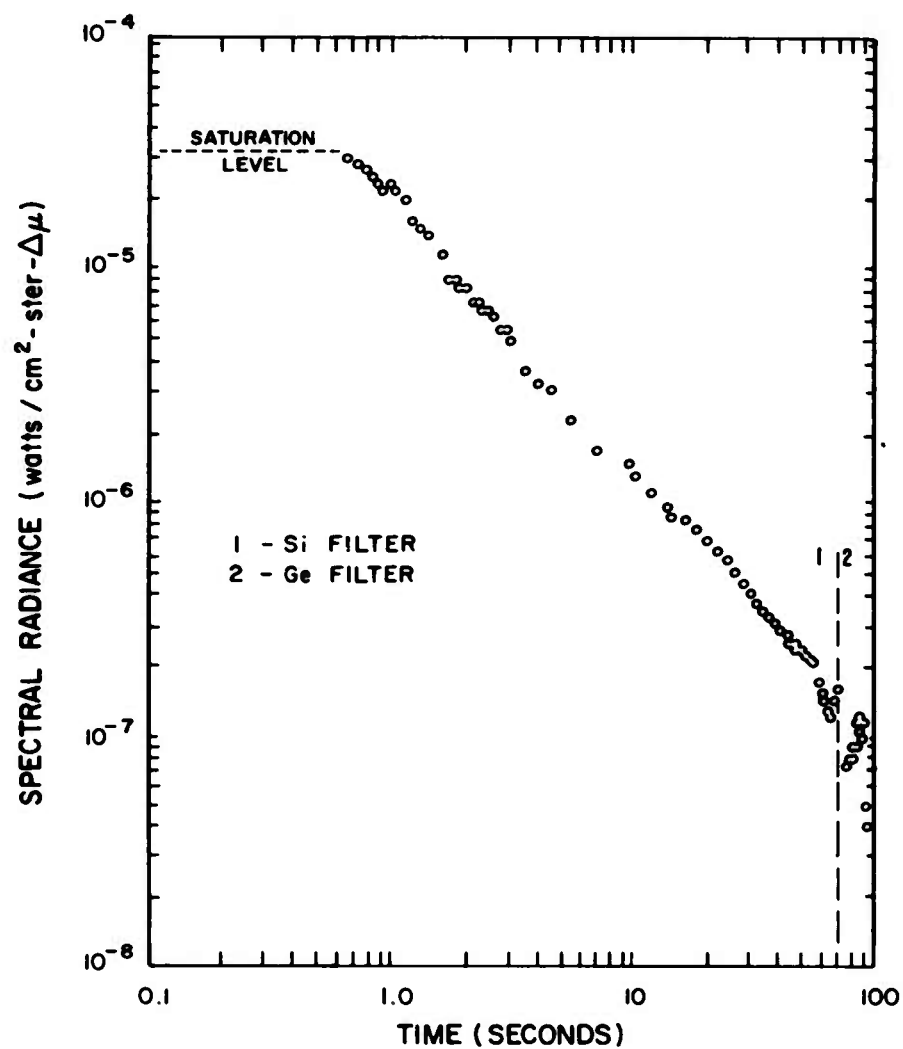


Figure 3.326 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 18, early time.



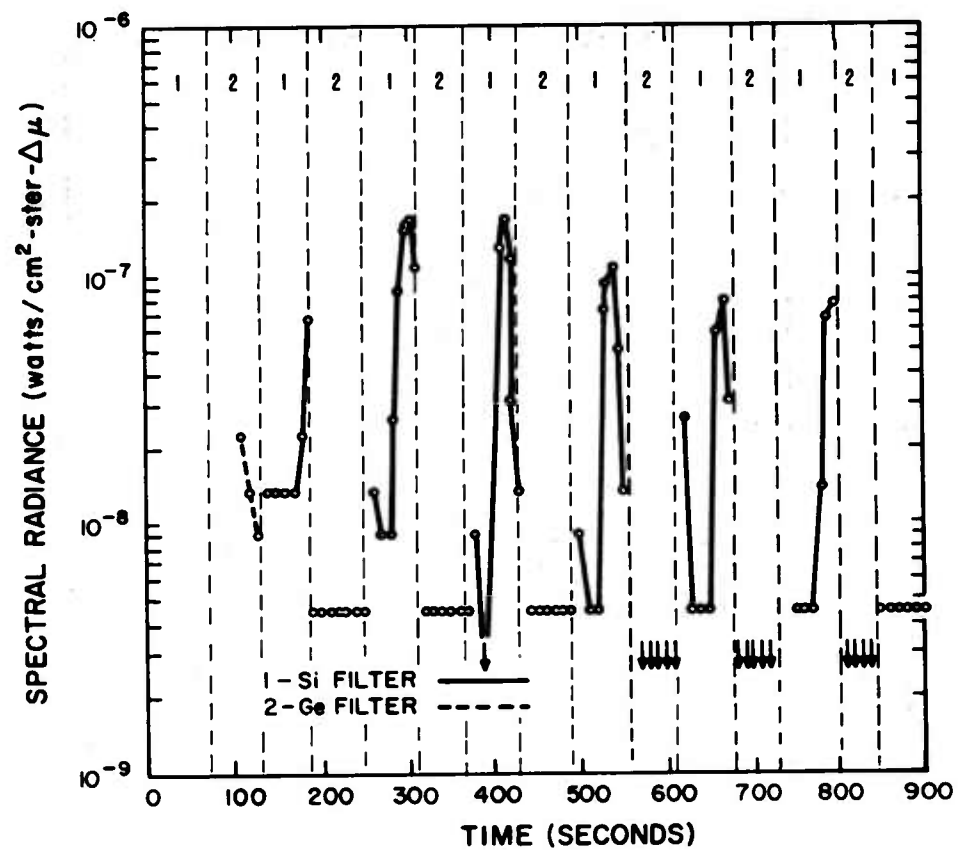


Figure 3.327 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 18, late time.

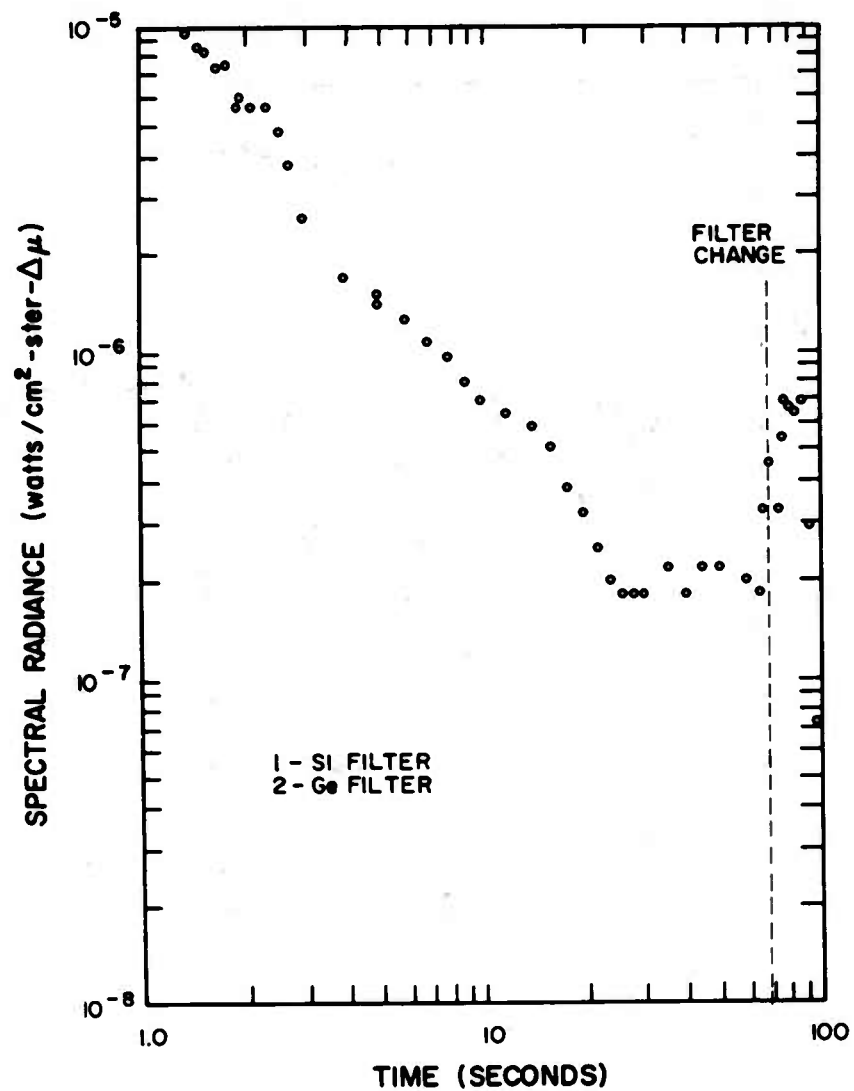


Figure 3.328 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 19, early time.

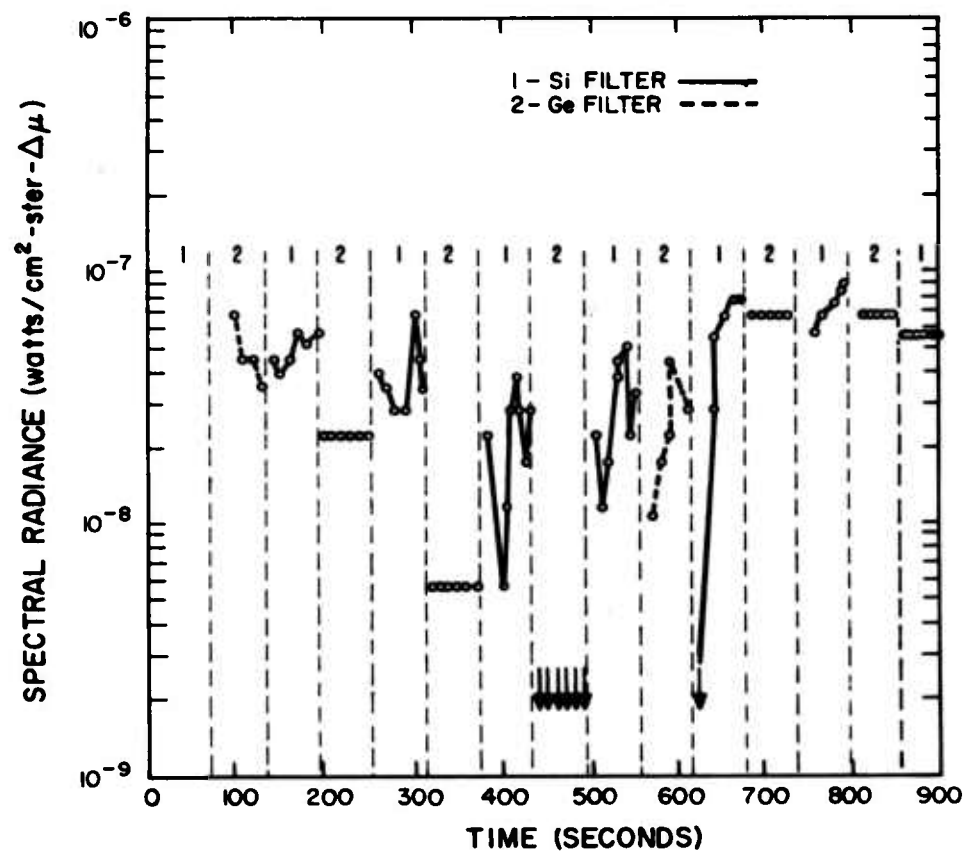


Figure 3.329 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 19, late time.

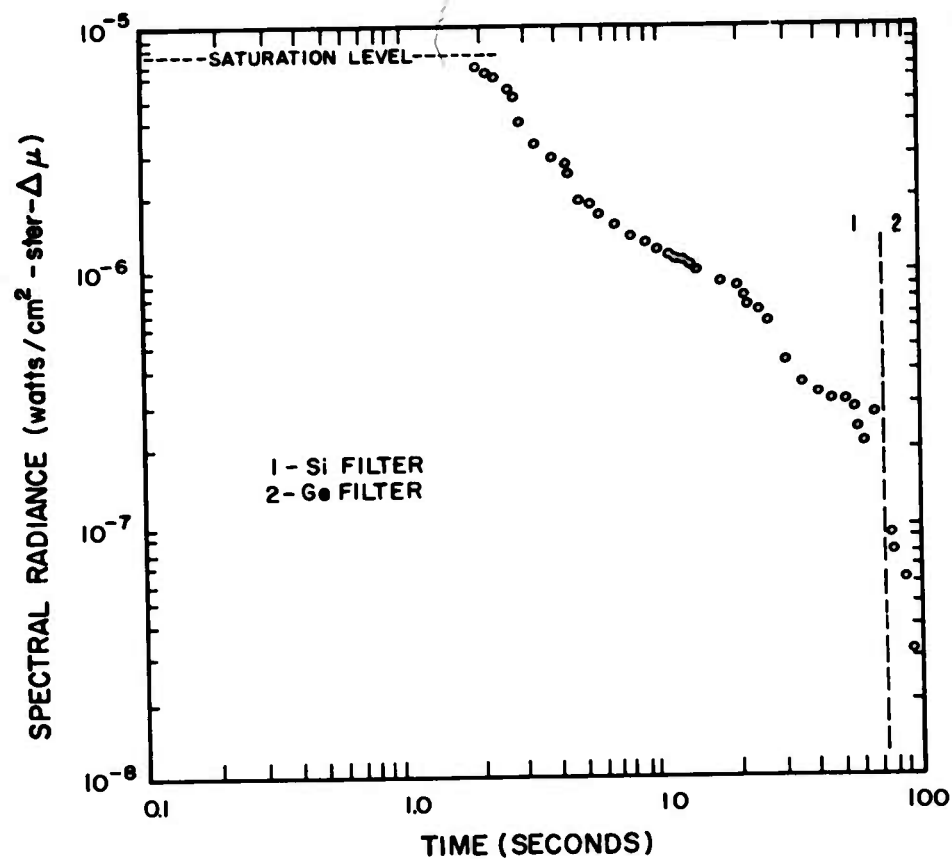


Figure 3.330 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 20, early time.

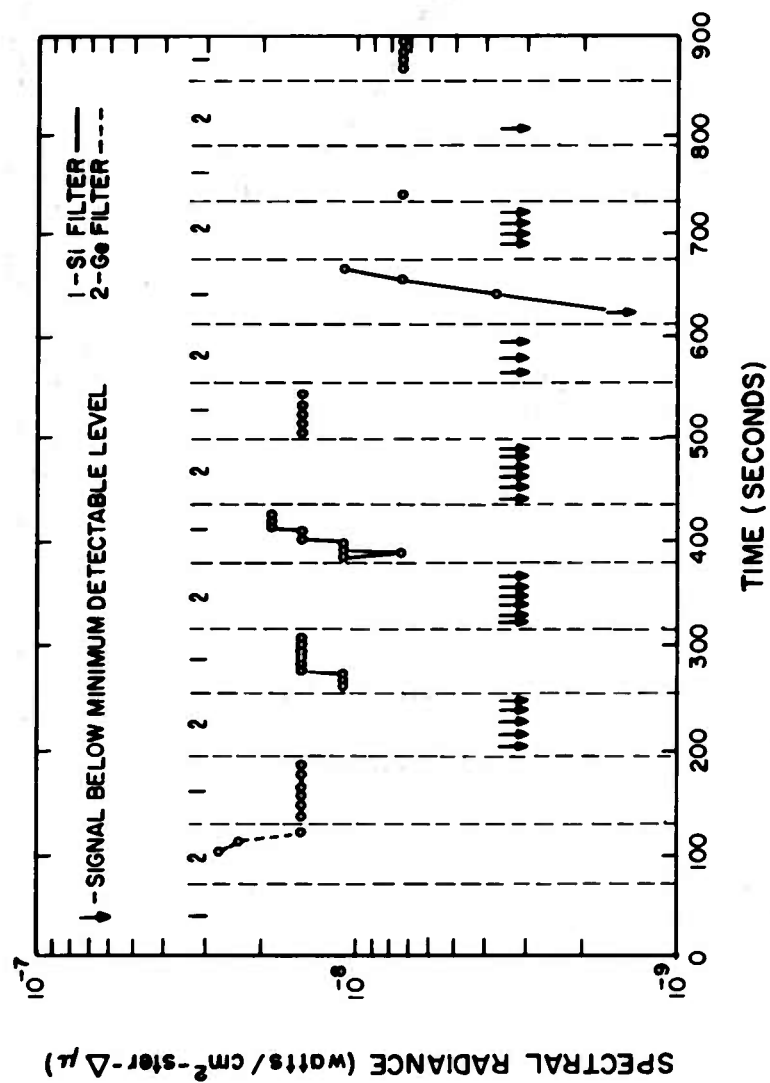


Figure 3.331 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 20, late time.

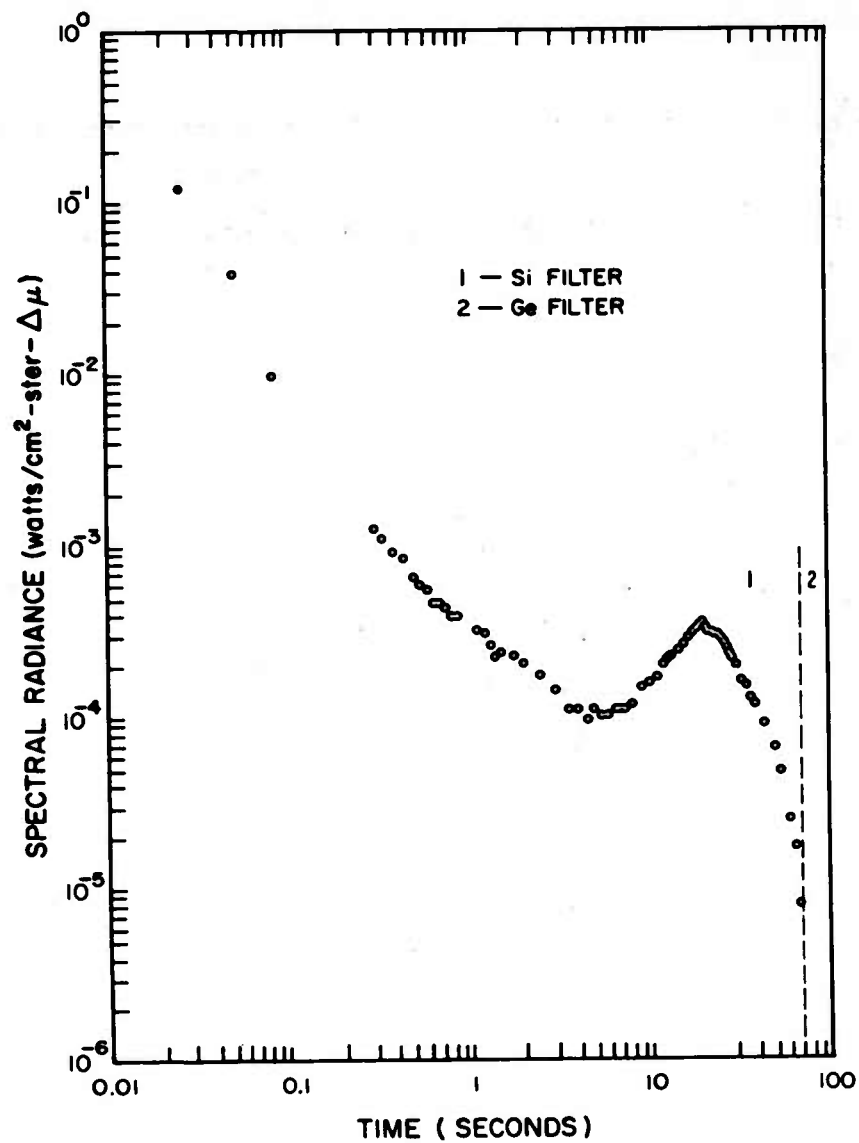


Figure 3.332 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 21, early time.

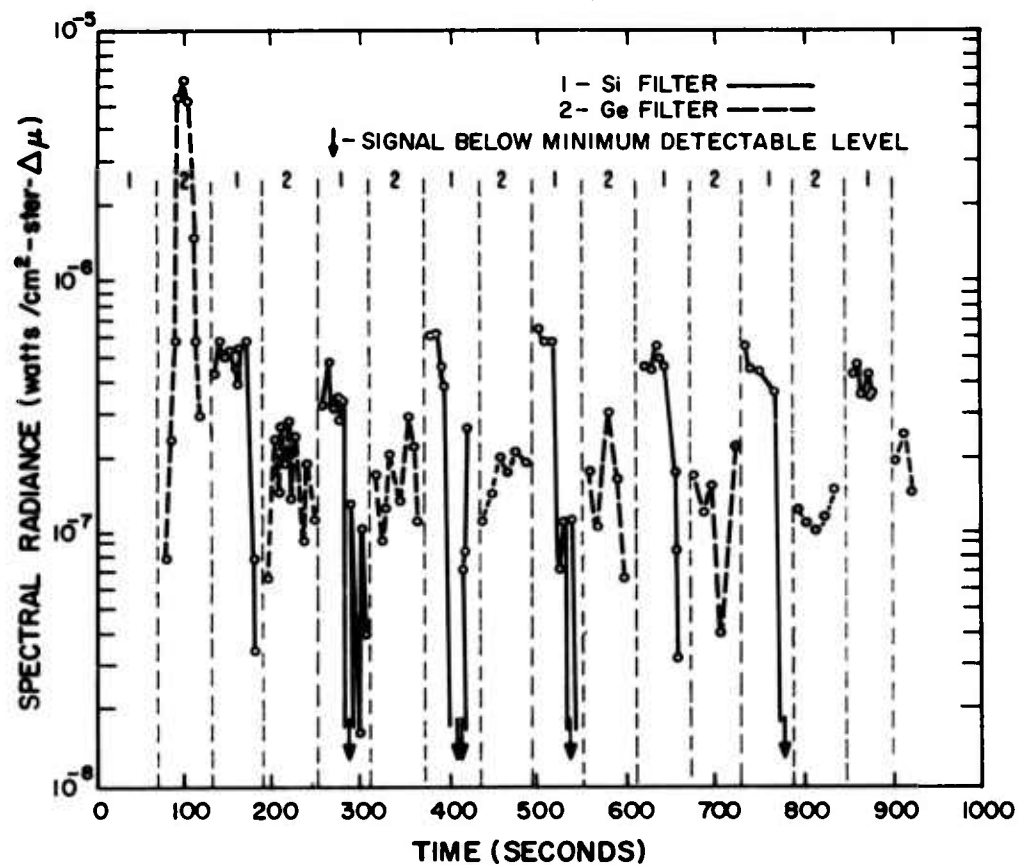


Figure 3.333 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 21, late time.

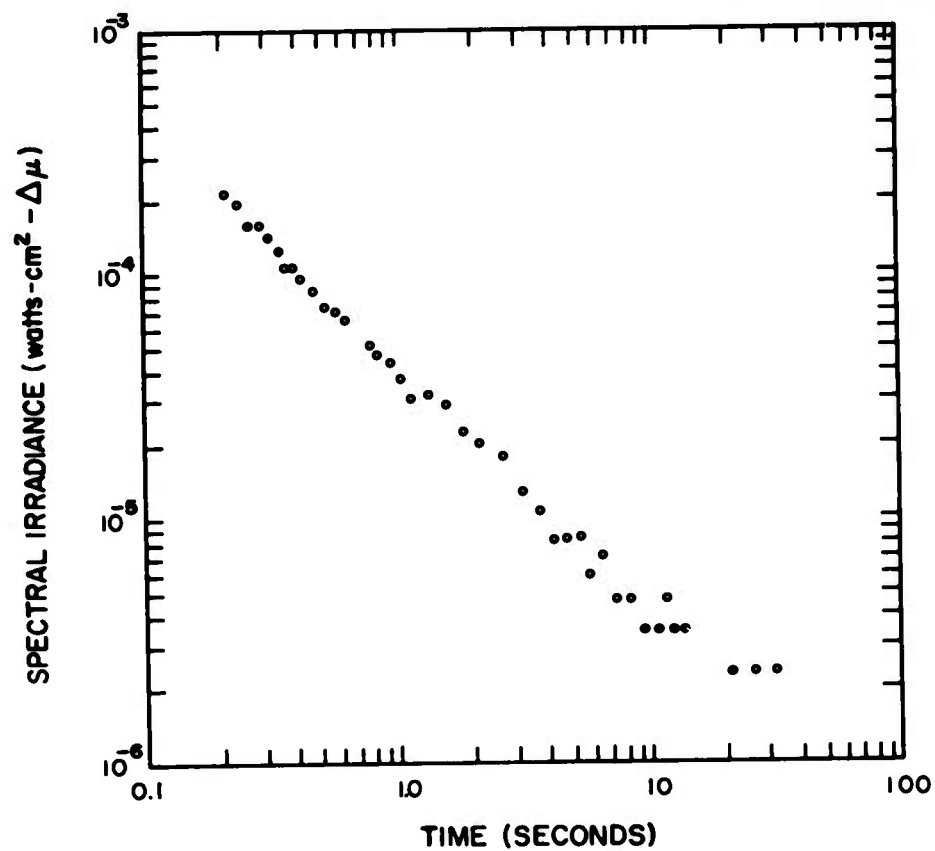


Figure 3.334 Spectral radiance, Kettle II, Blue Gill Triple Prime, Channel 22.



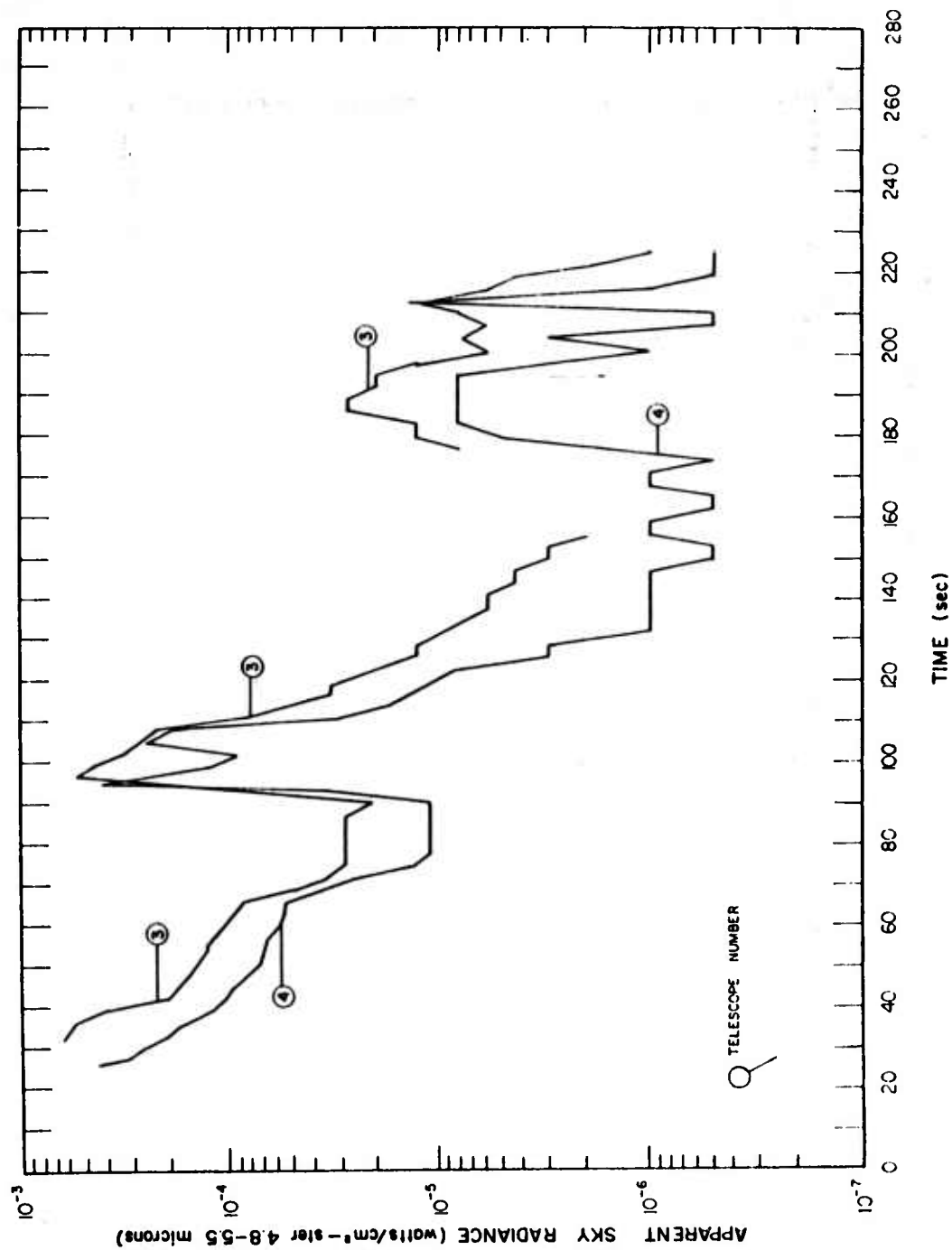


Figure 3.335 5.0 micron data, Blue Gill Triple Prime.

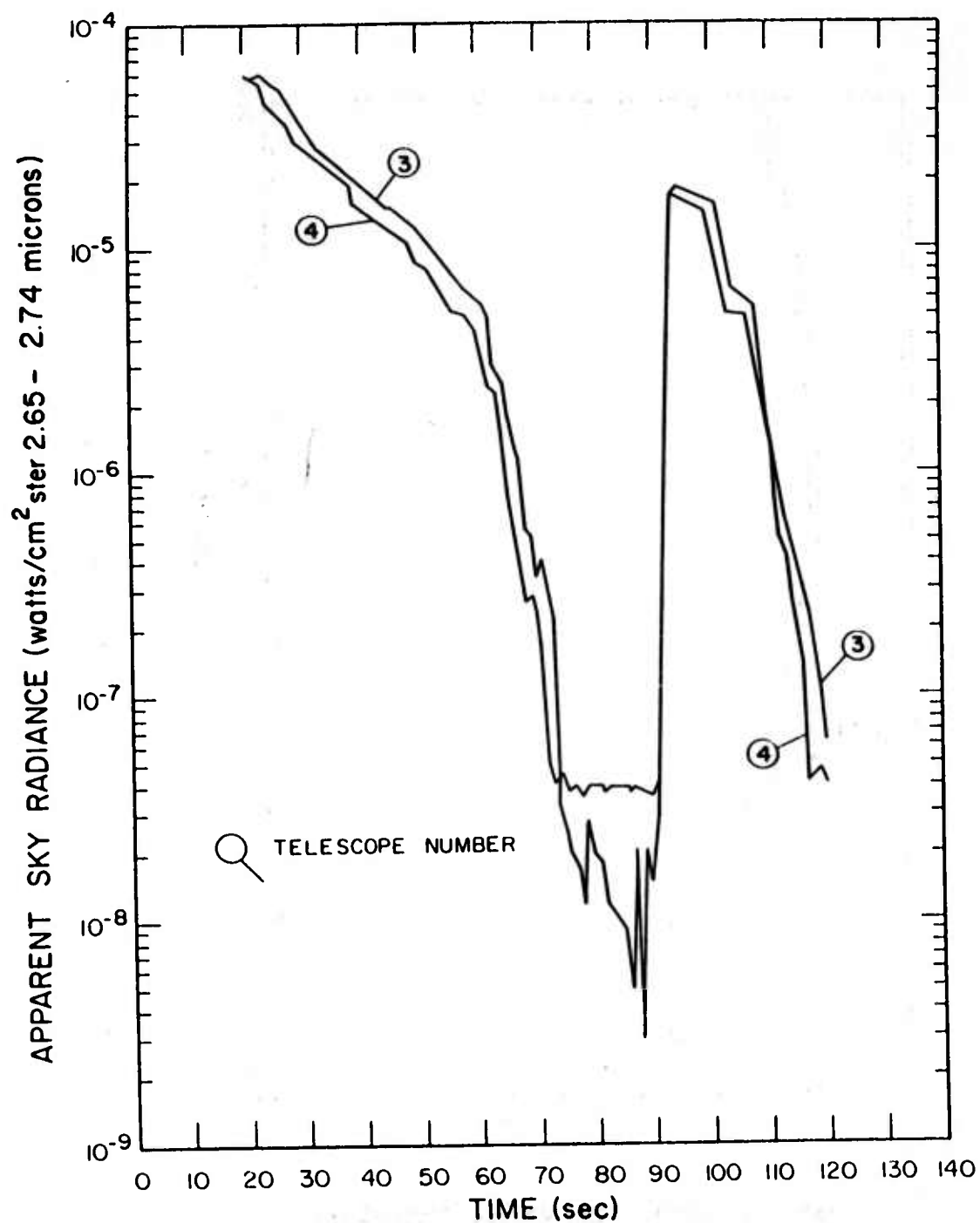


Figure 3.336 2.7-micron data, Blue Gill Triple Prime.

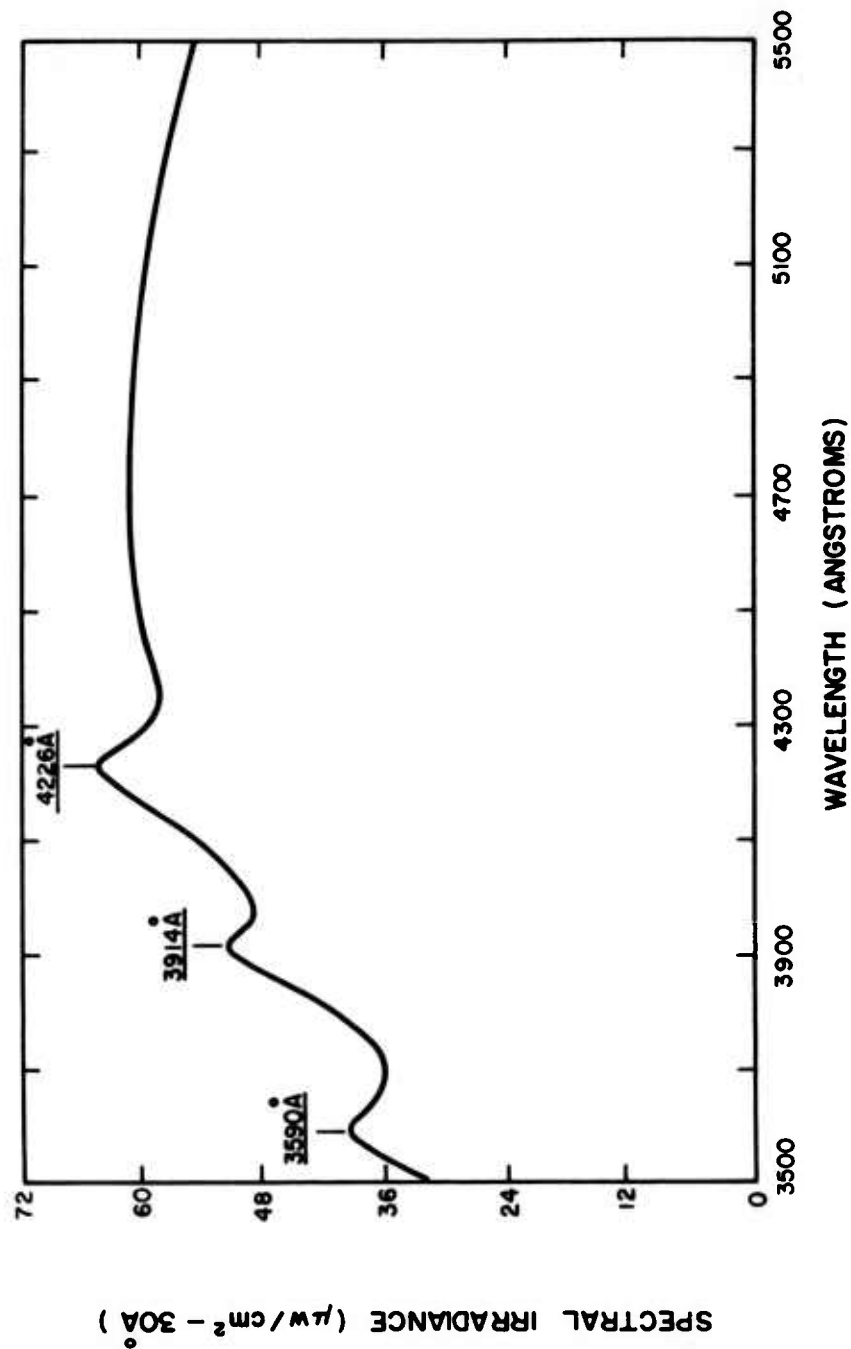


Figure 3.337 Spectrogram at H + 1,602 msec, Kettle I, Blue Gill Triple Prime.

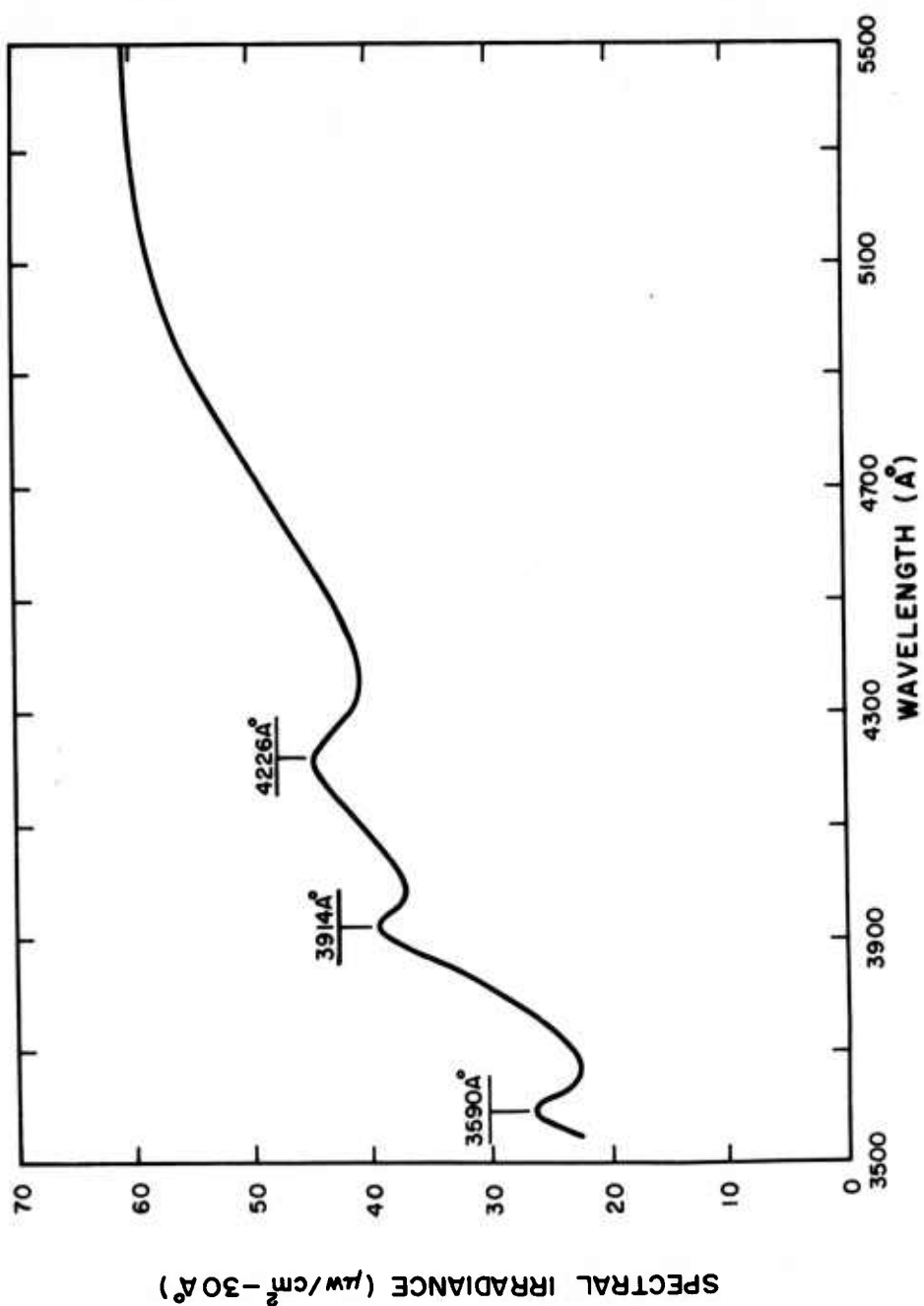


Figure 3.338 Spectrogram at H + 2,250 msec, Kettle I, Blue Gill Triple Prime.

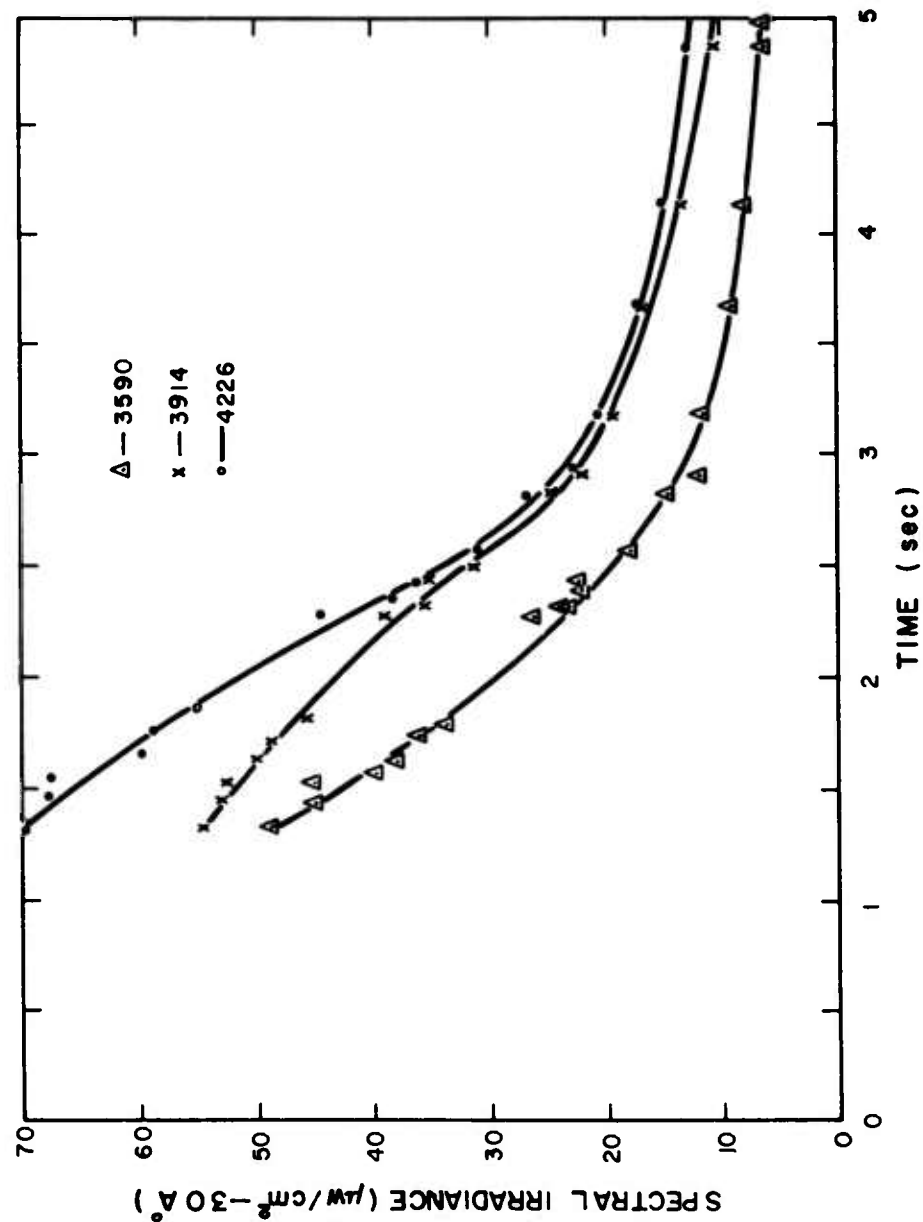


Figure 3.339 Decay of spectral irradiance at three wavelengths, Kettle I, Blue Gill Triple Prime.

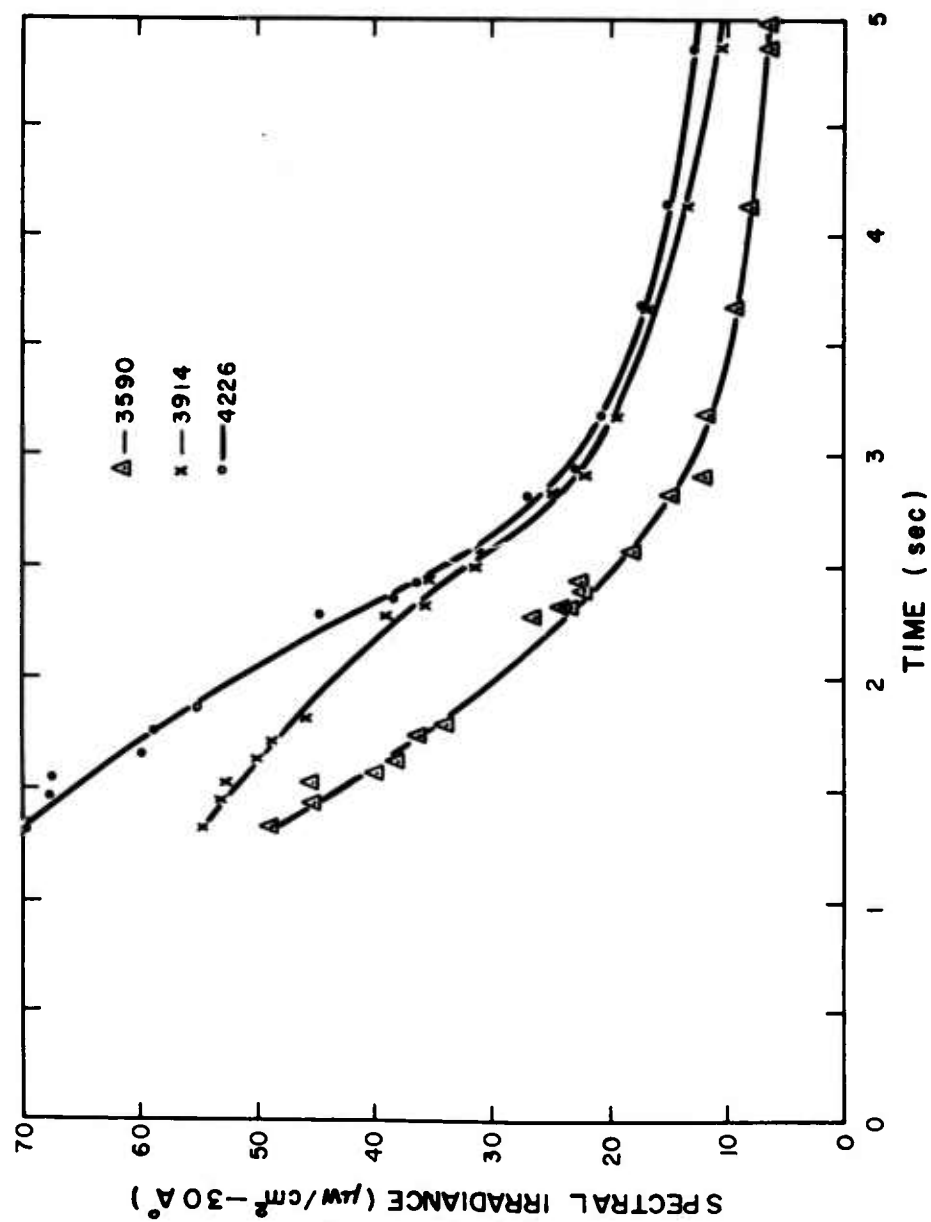


Figure 3.339 Decay of spectral irradiance at three wavelengths, Kettle I, Blue Gill Triple Prime.

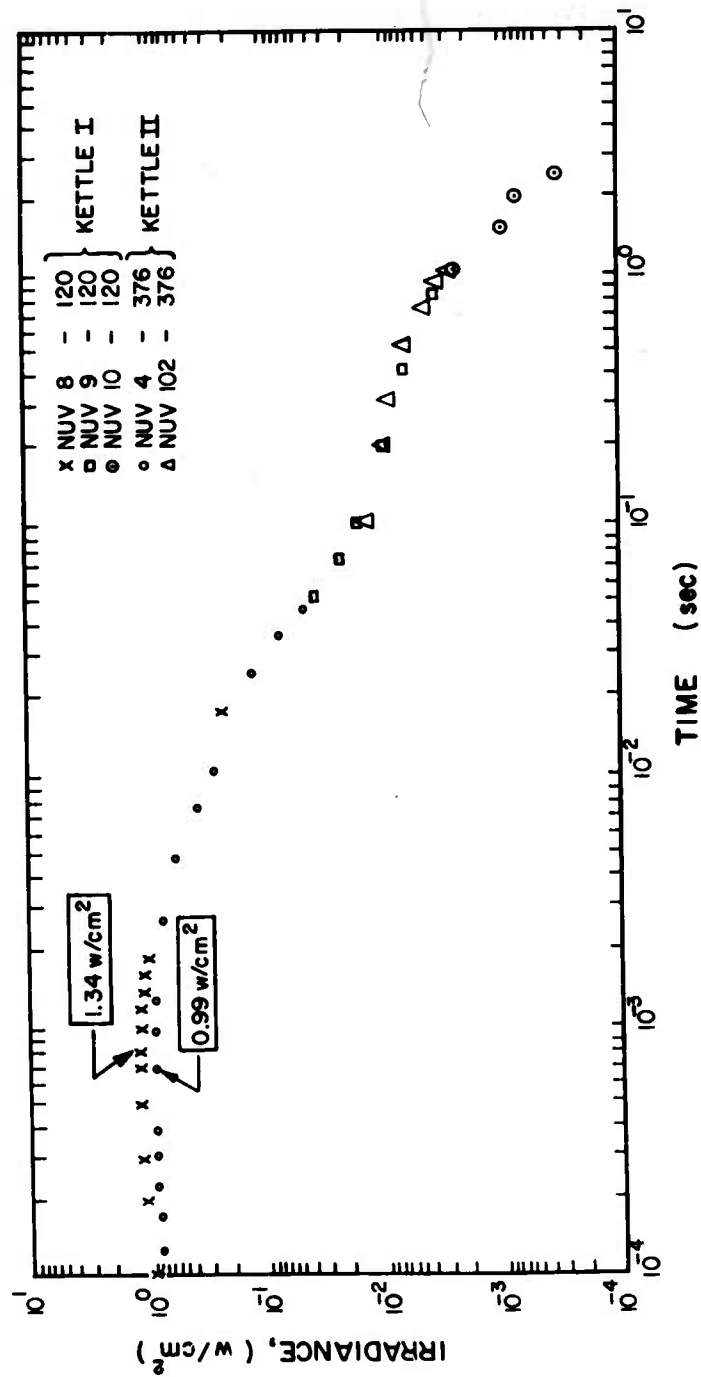


Figure 3.340 Irradiance at aircraft stations, Blue Gill Triple Prime, in spectral region 0.29 to 0.40  $\mu$ .

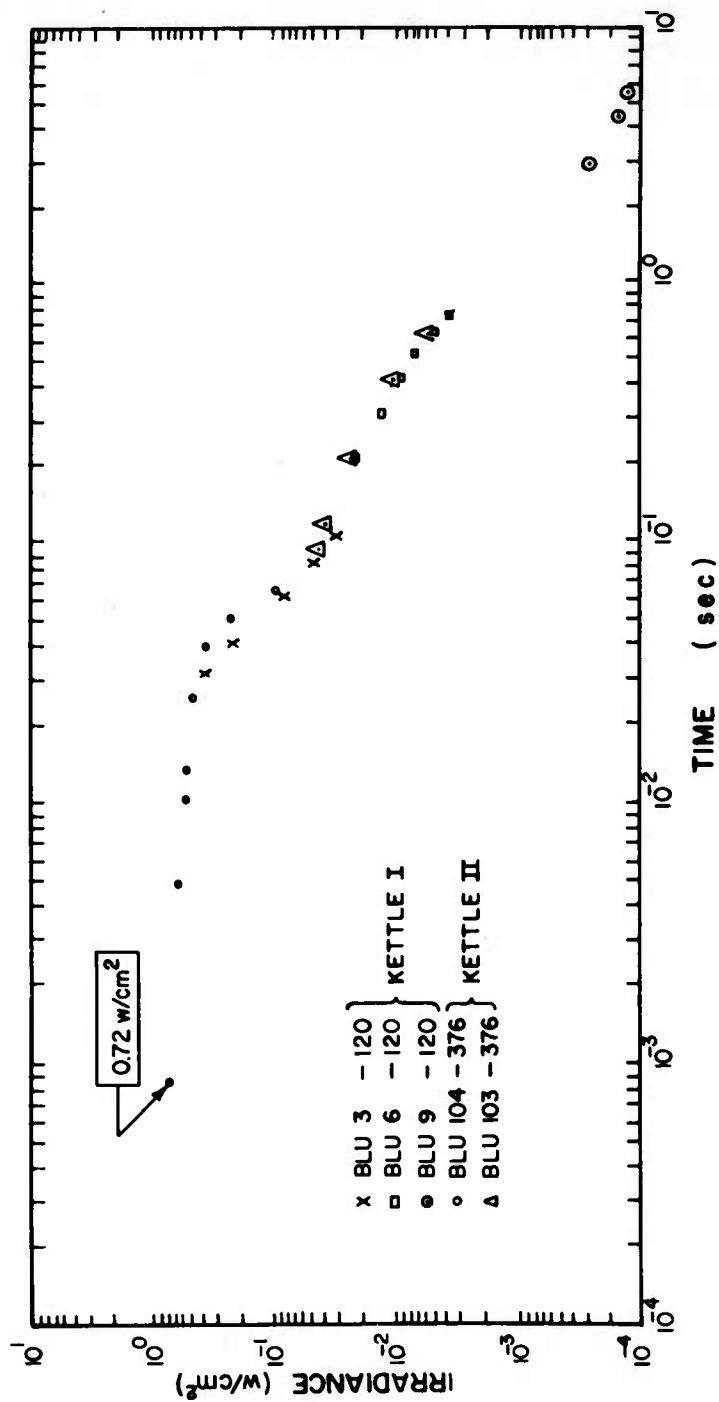


Figure 3.341 Irradiance at aircraft stations, Blue Gill Triple Prime, in spectral region 0.4 to 0.5  $\mu$ .





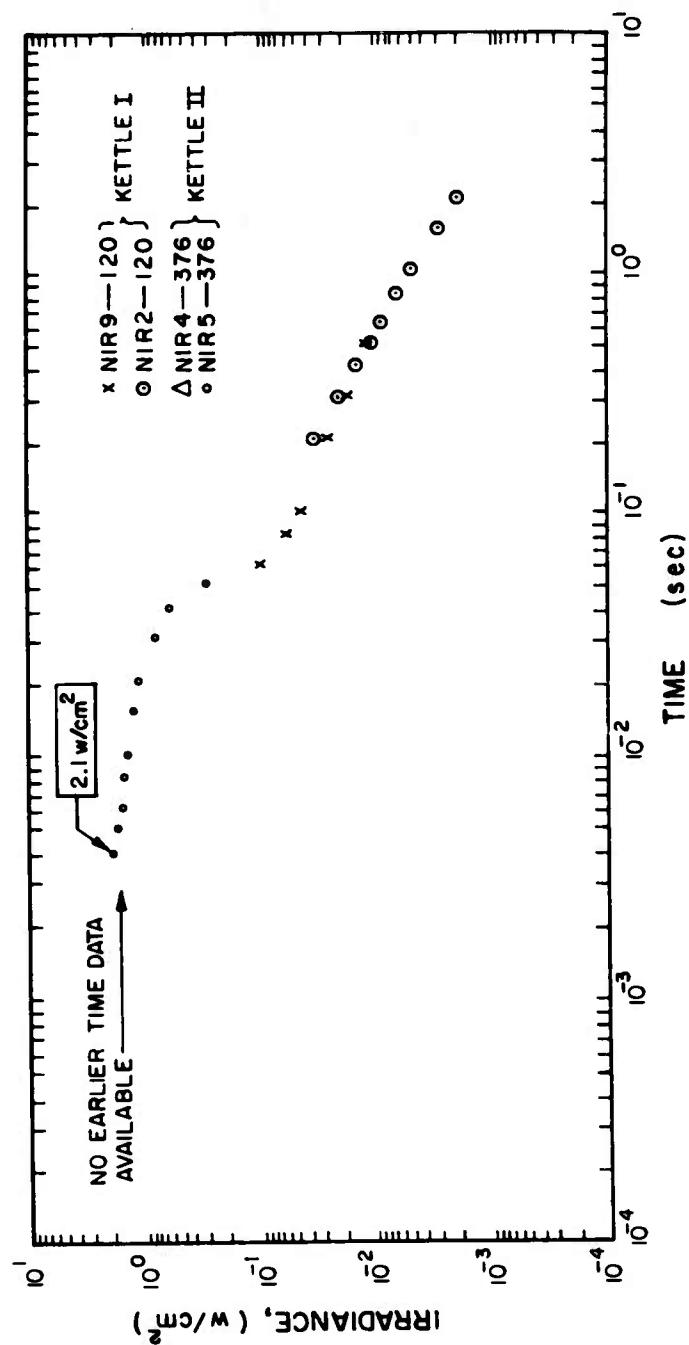


Figure 3.343 Irradiance at aircraft stations, Blue Gill Triple Prime, in spectral region of 0.75 to 1.0  $\mu$ .

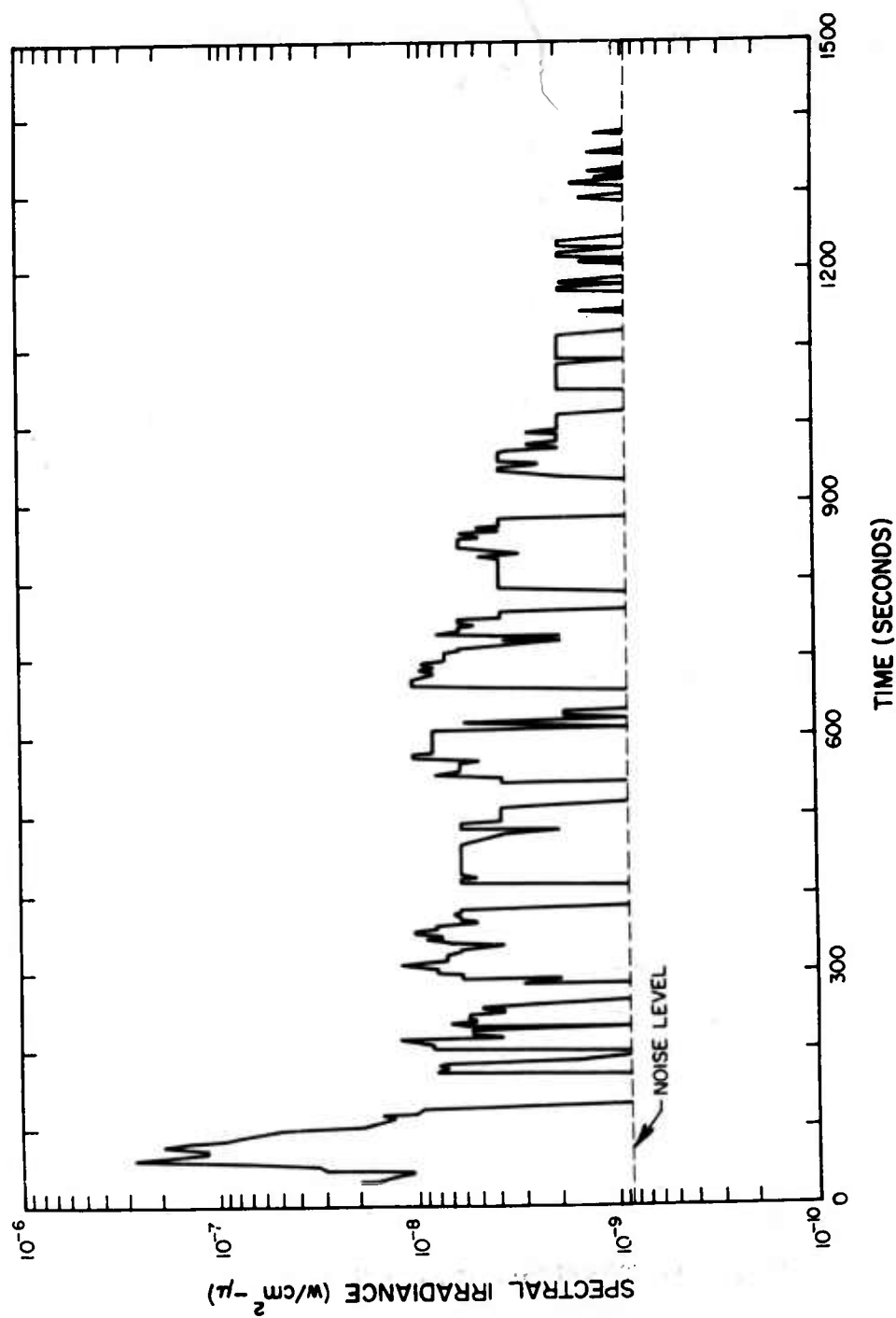


Figure 3.344 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 1.55 to 1.615  $\mu$ .

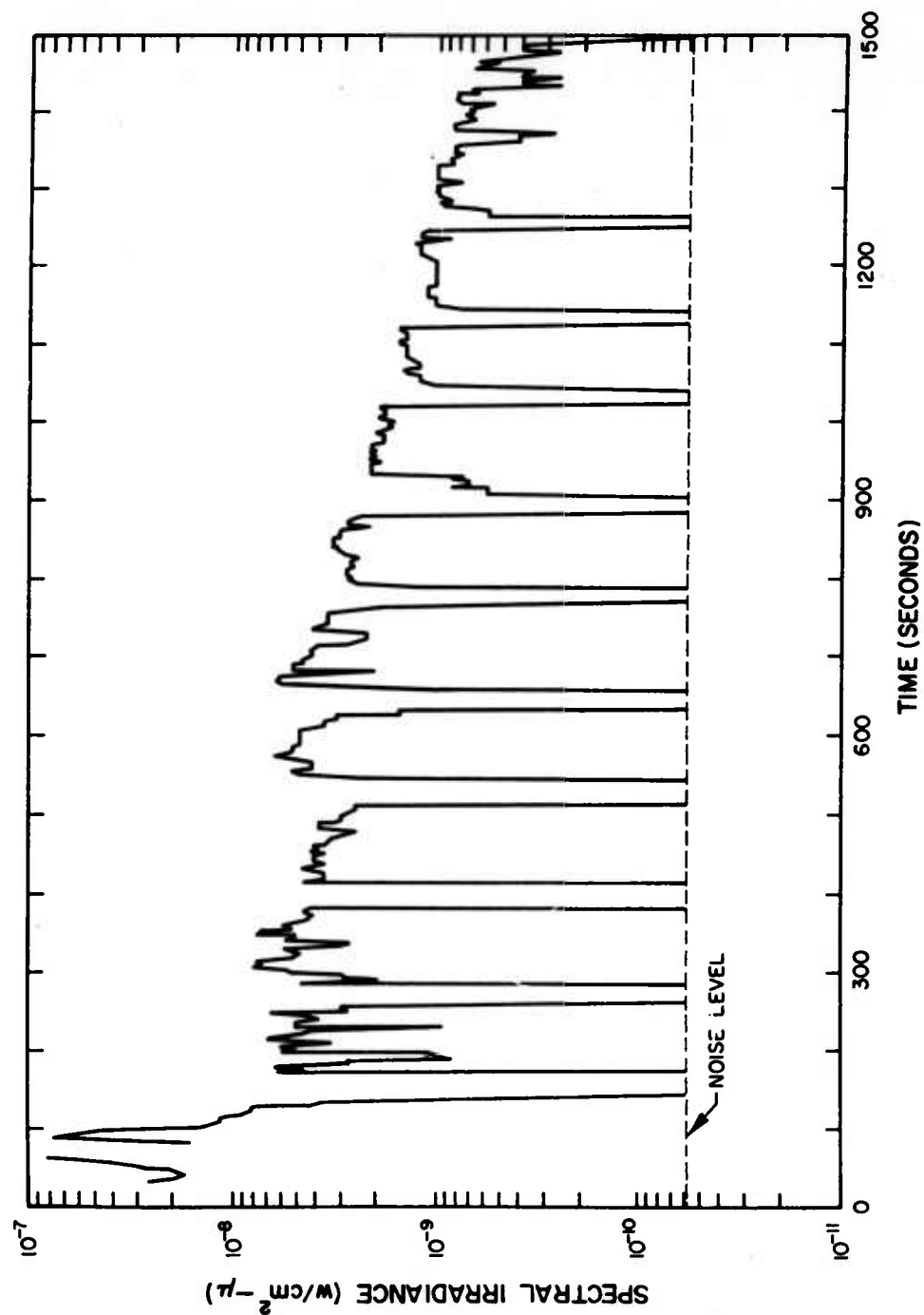


Figure 3.345 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 1.62 to 1.93  $\mu$  (0 to 1,500 sec).

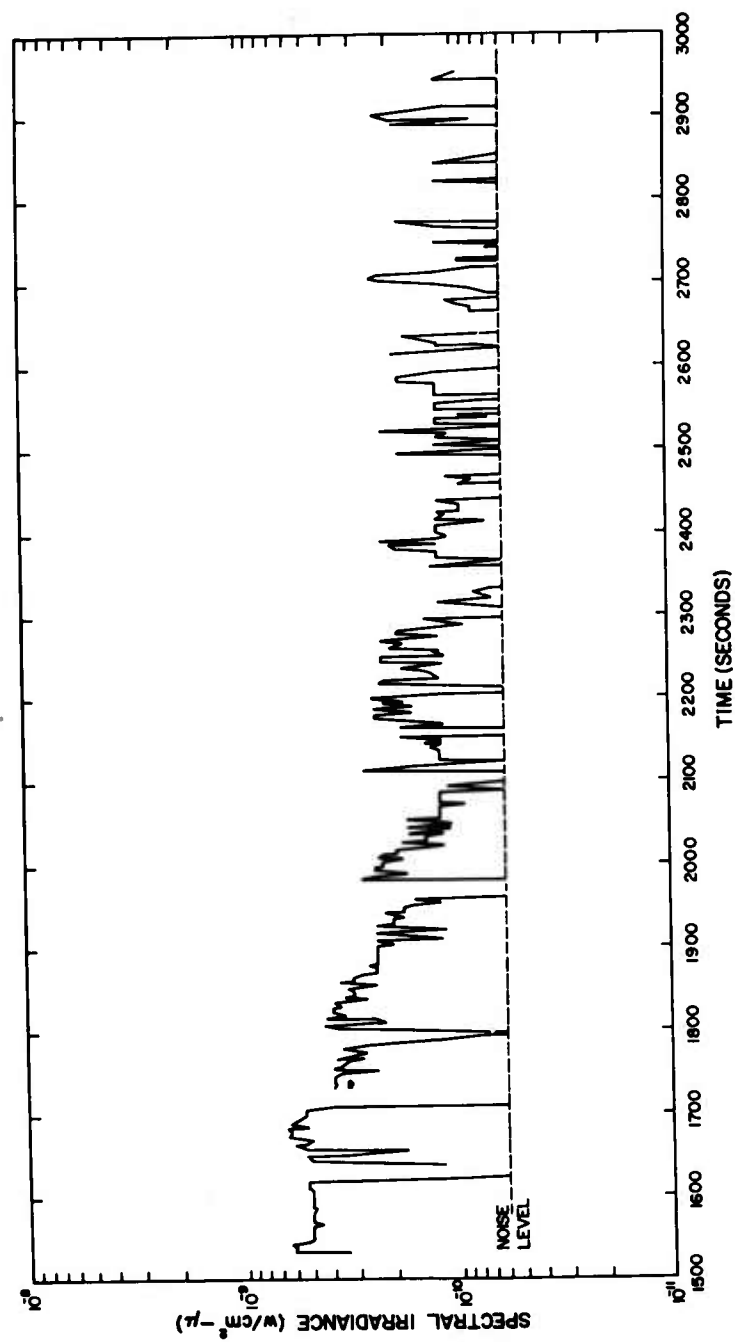


Figure 3.346 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 1.62 to 1.93  $\mu$  (1,500 to 3,000 sec).

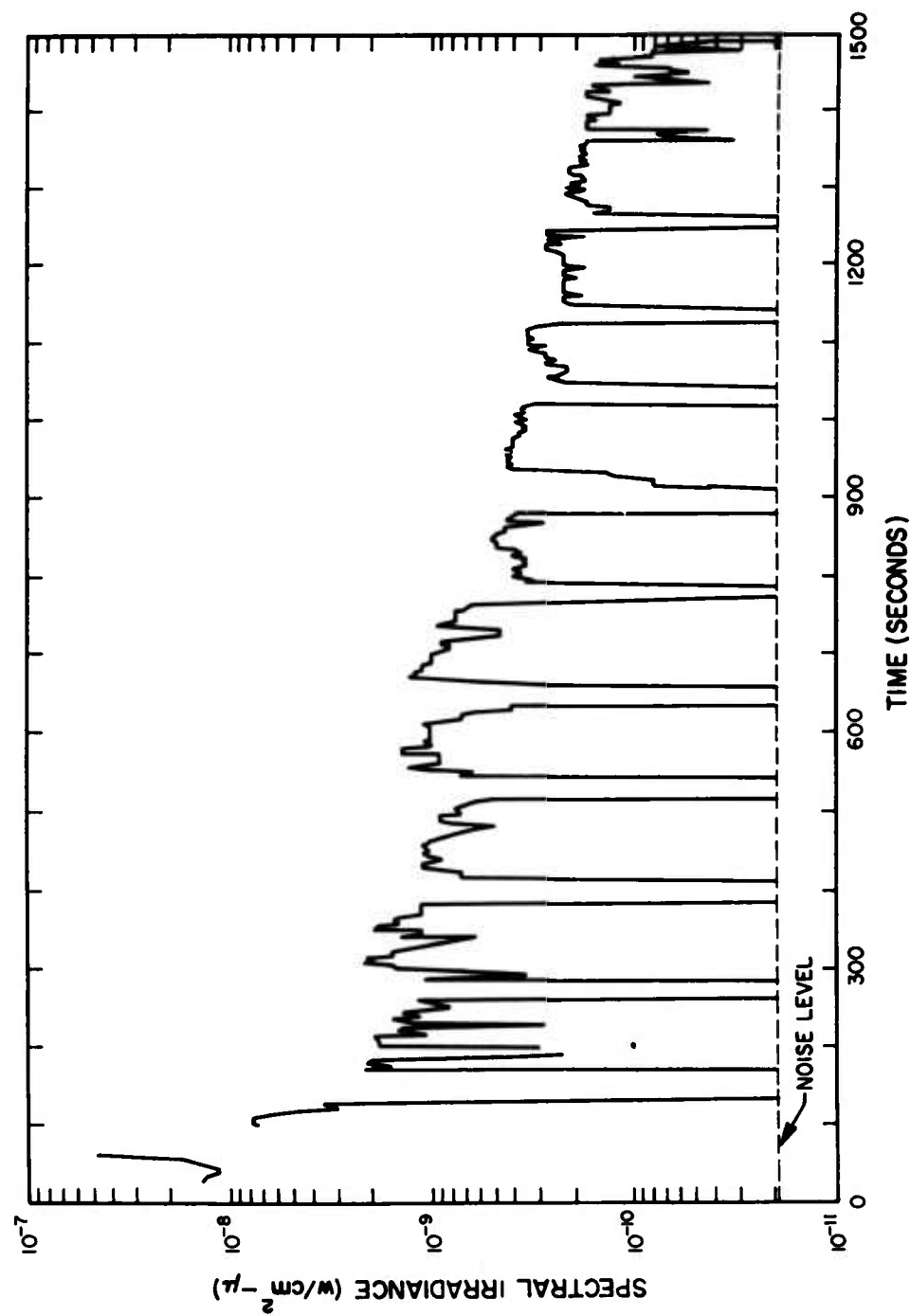


Figure 3.347 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 1.87 to 2.56  $\mu$  (0 to 1,500 sec).

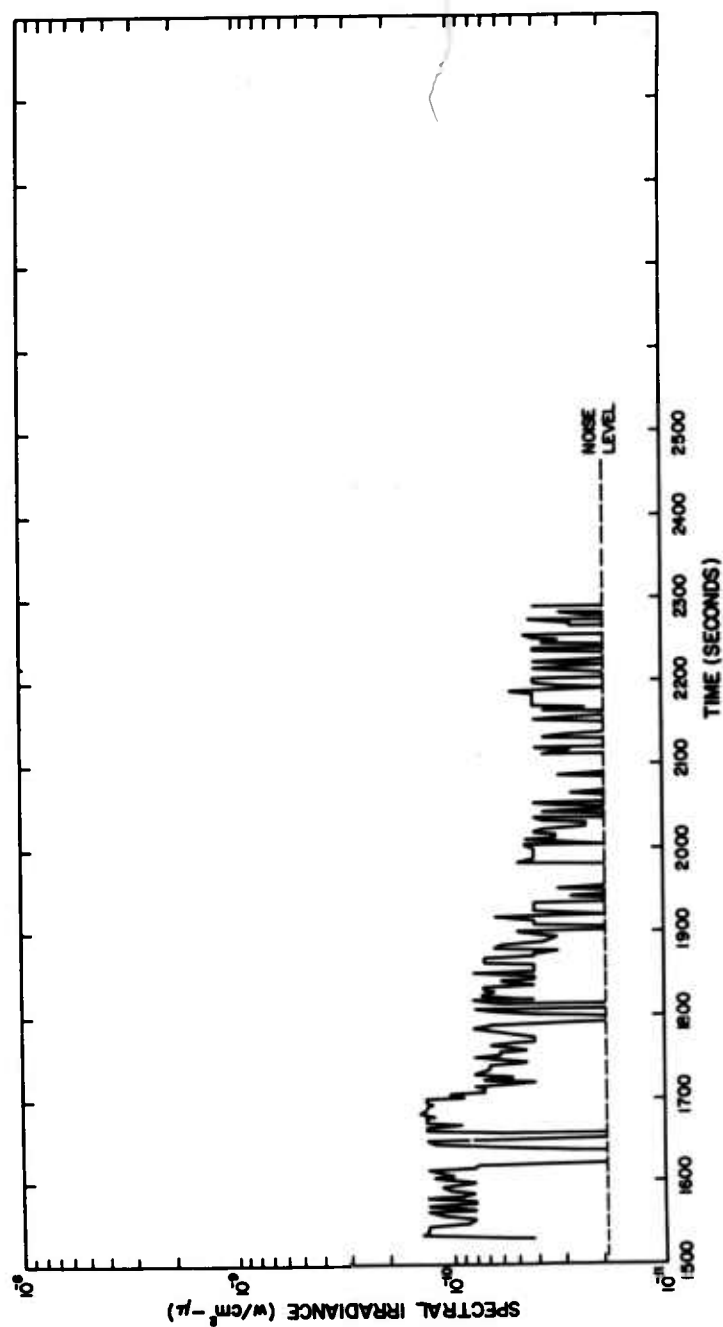


Figure 3.348 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 1.87 to 2.56  $\mu$  (1,500 to 2,300 sec).

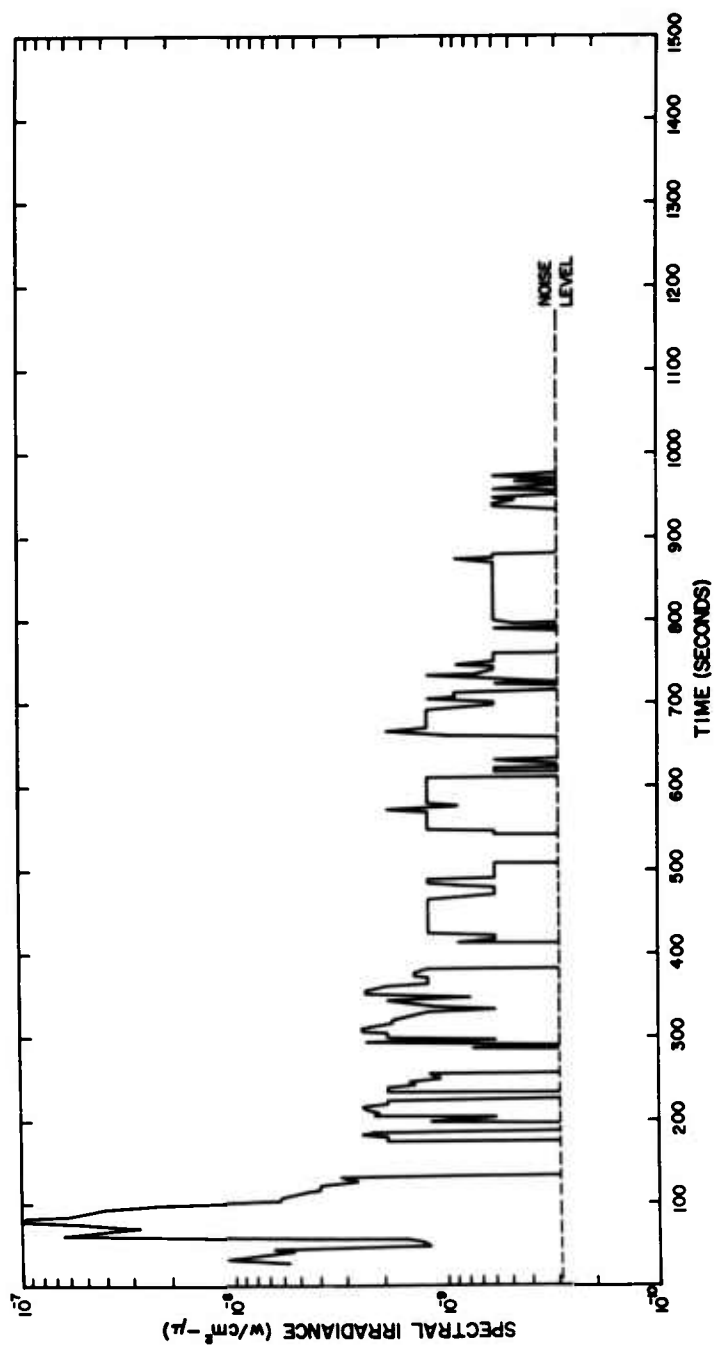


Figure 3.349 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 2.15 to 2.21  $\mu$ .



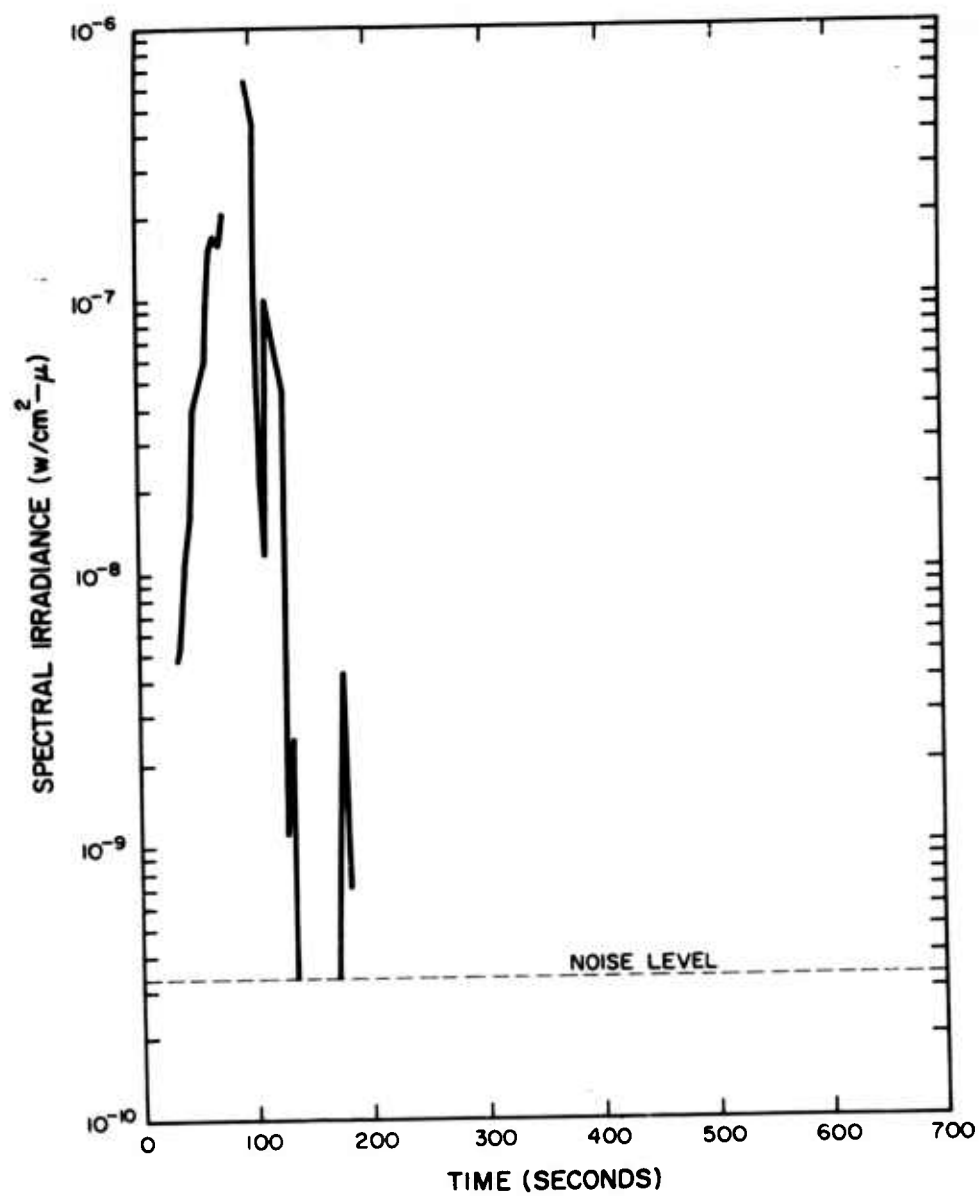


Figure 3.350 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 2.645 to 2.72  $\mu$ .

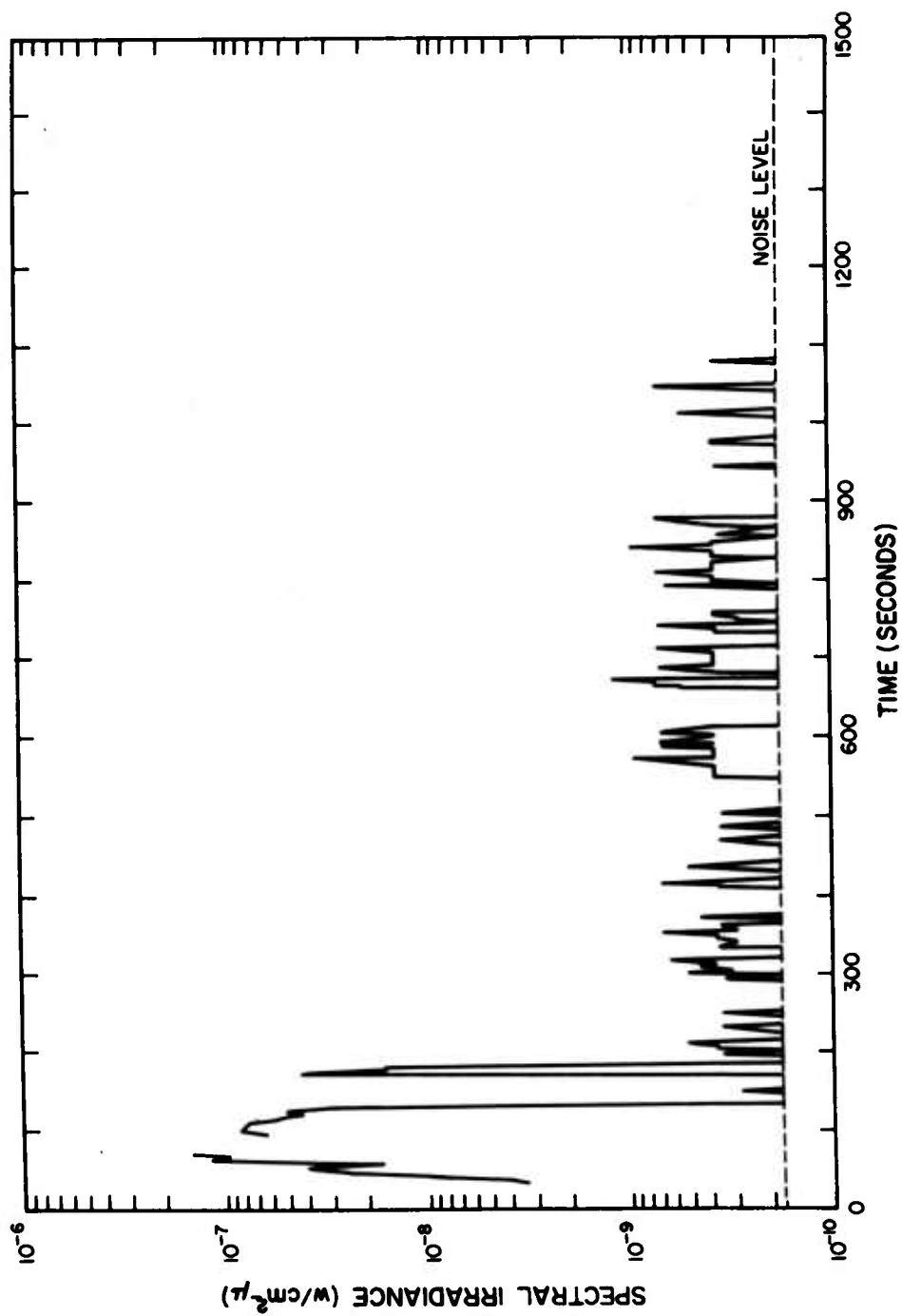


Figure 3.351 Irradiance, Kettle I, Blue Gill Triple Prime, in spectral region 2.65 to 2.79  $\mu$ .

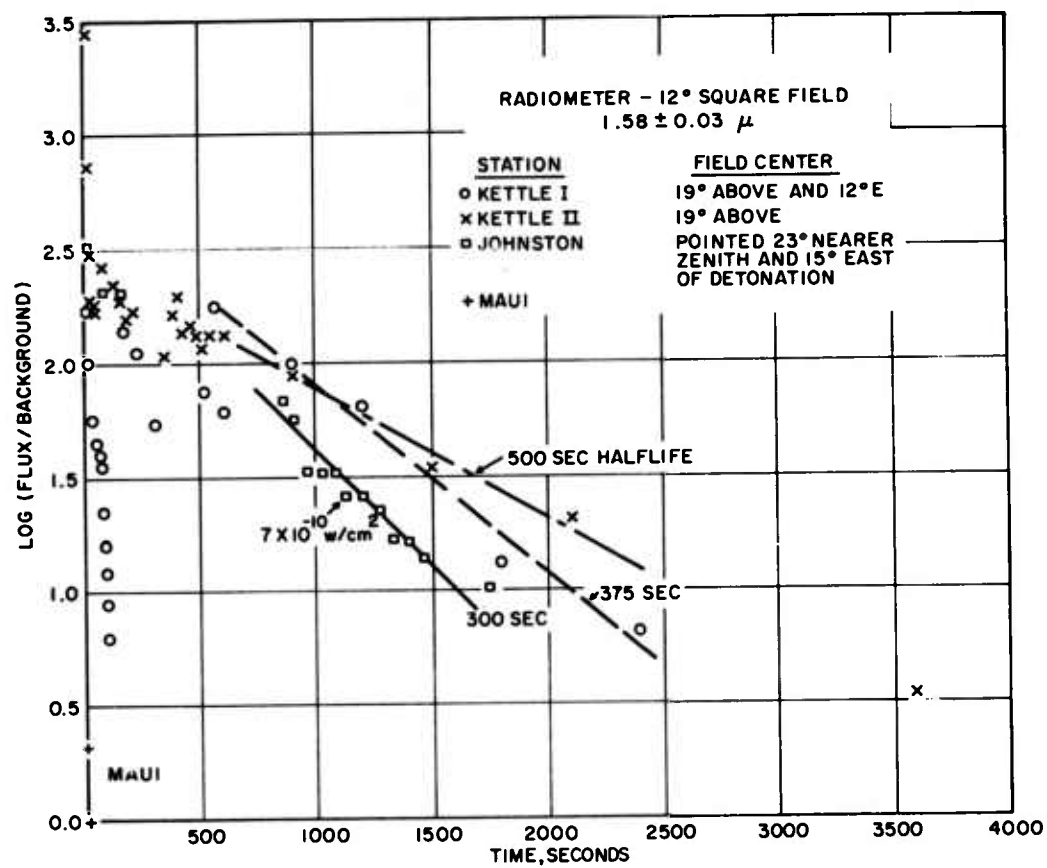


Figure 3.352 Radiometer results from all stations, Blue Gill Triple Prime.

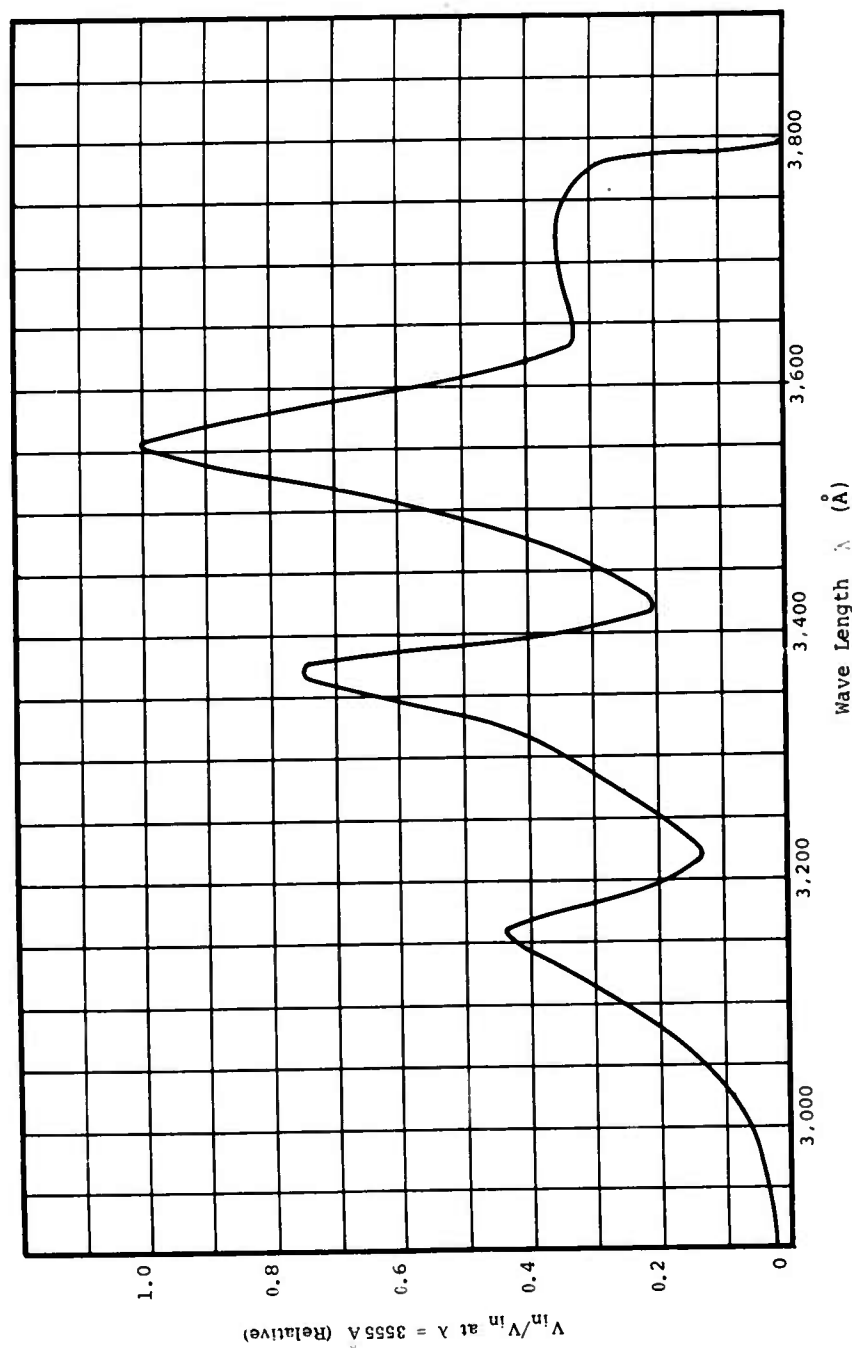
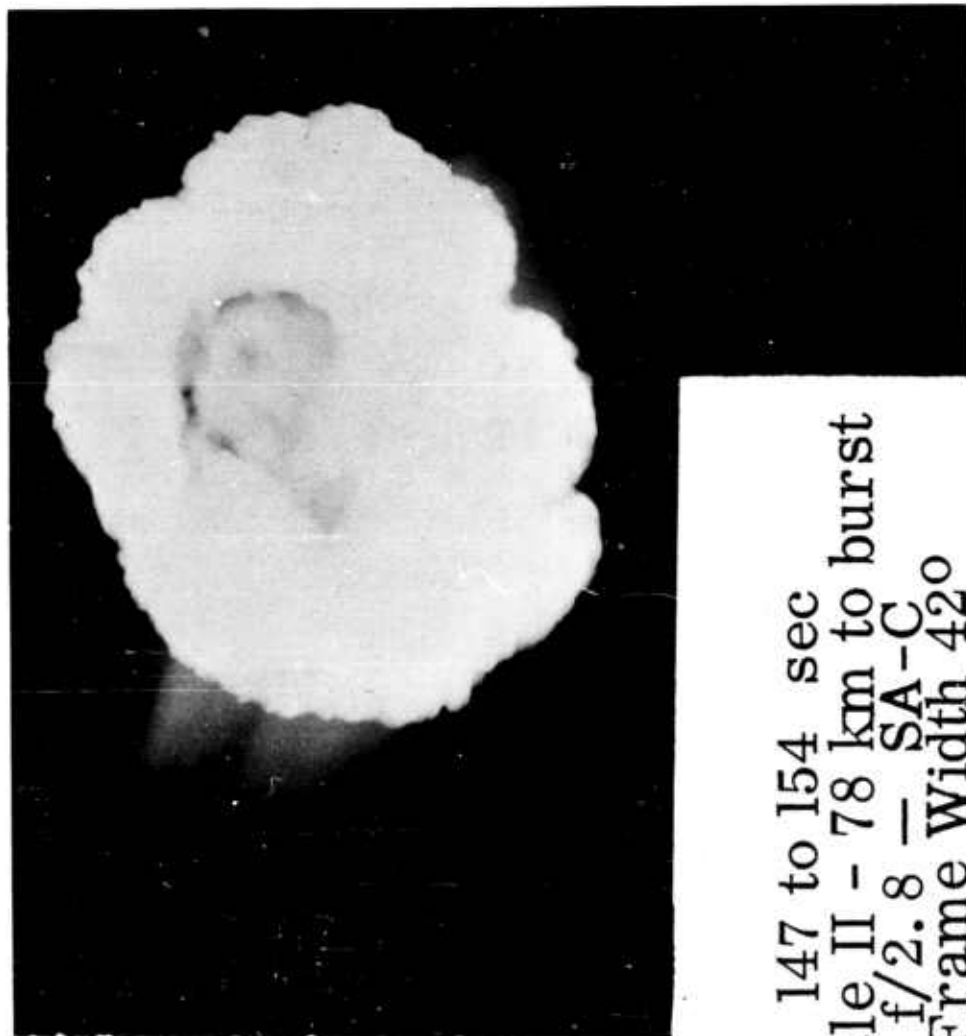
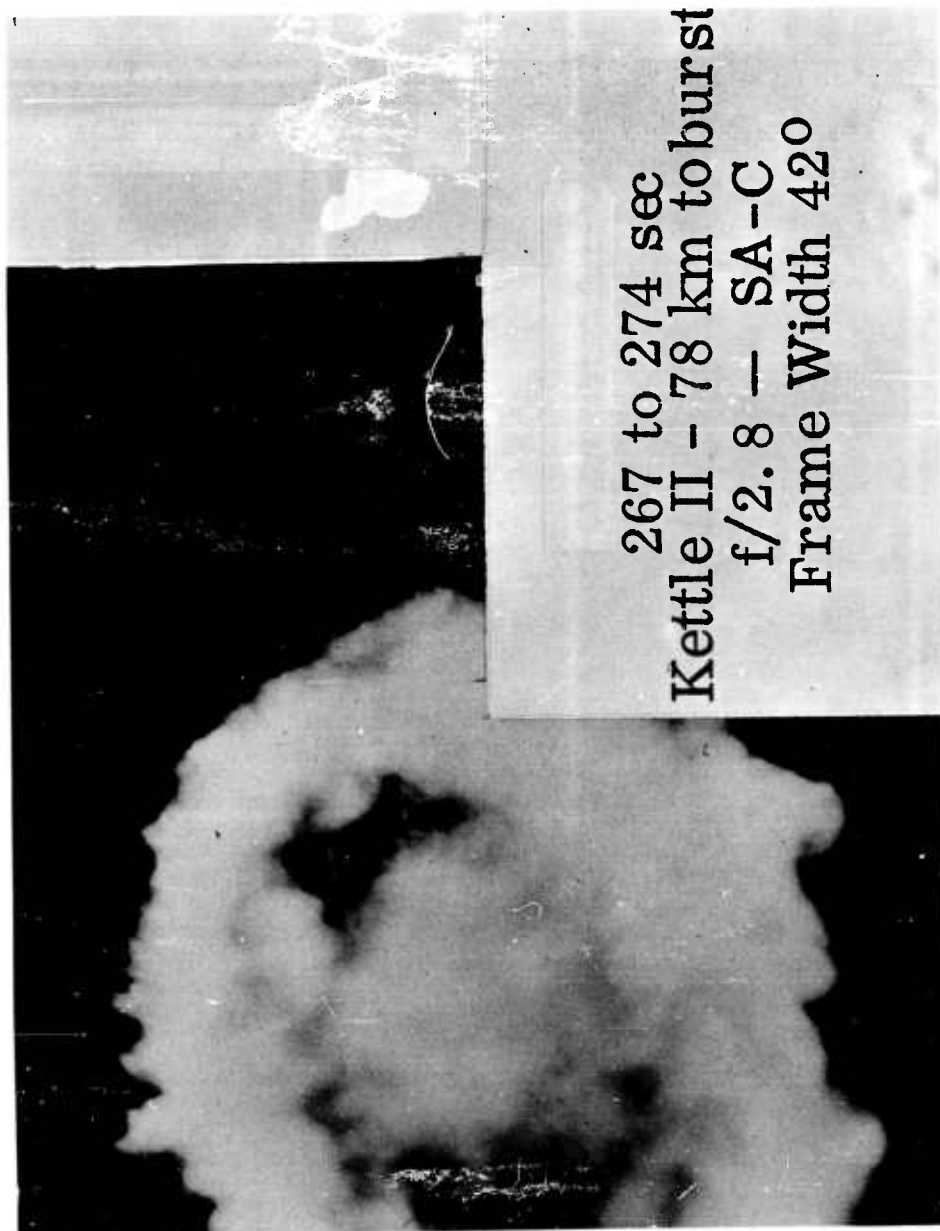


Figure 3.353 Normalized UV spectrogram at H+176 seconds, Kettle I, BlueGill Triple Prime.



147 to 154 sec  
Kettle II - 78 km to burst  
f/2.8 - SA-C  
Frame Width 42°

Figure 3.354 Photo from Kettle II, 147 to 154 seconds, Blue Gill Triple Prime.



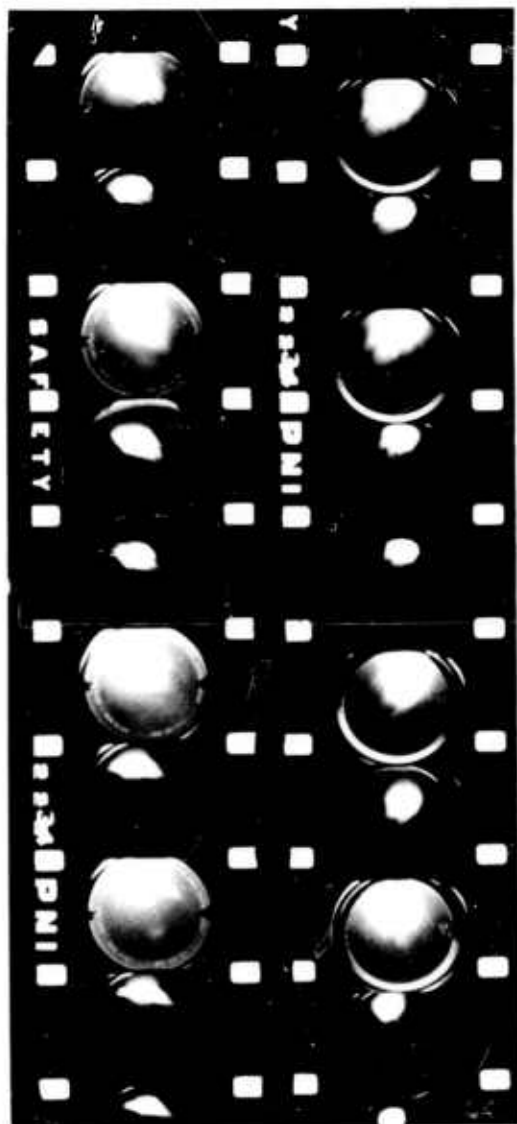
267 to 274 sec  
Kettle II - 78 km to burst  
f/2.8 - SA-C  
Frame Width 42°

Figure 3.355 Photo from Kettle II, 267 to 274 seconds, Blue Gill Triple Prime.



567 to 574 sec — f/2.8 — SA-C  
Kettle II - 78 km to burst  
Frame Width 420

Figure 3.356 Photo from Kettle II, 567 to 574 seconds, Blue Gill Triple Prime.



120 sec to 240 sec  
 Exposure times 2, 4, 25, 4, 25,  
 2, 4, 25, 4, 25, sec  
 Top Kettle II E - Bottom Kettle I N  
 T/1.64 - Super Anscochrome  
 All-Sky Frame 155° through window

Figure 3.357 All-sky photos from both aircraft, Blue Gill Triple Prime.



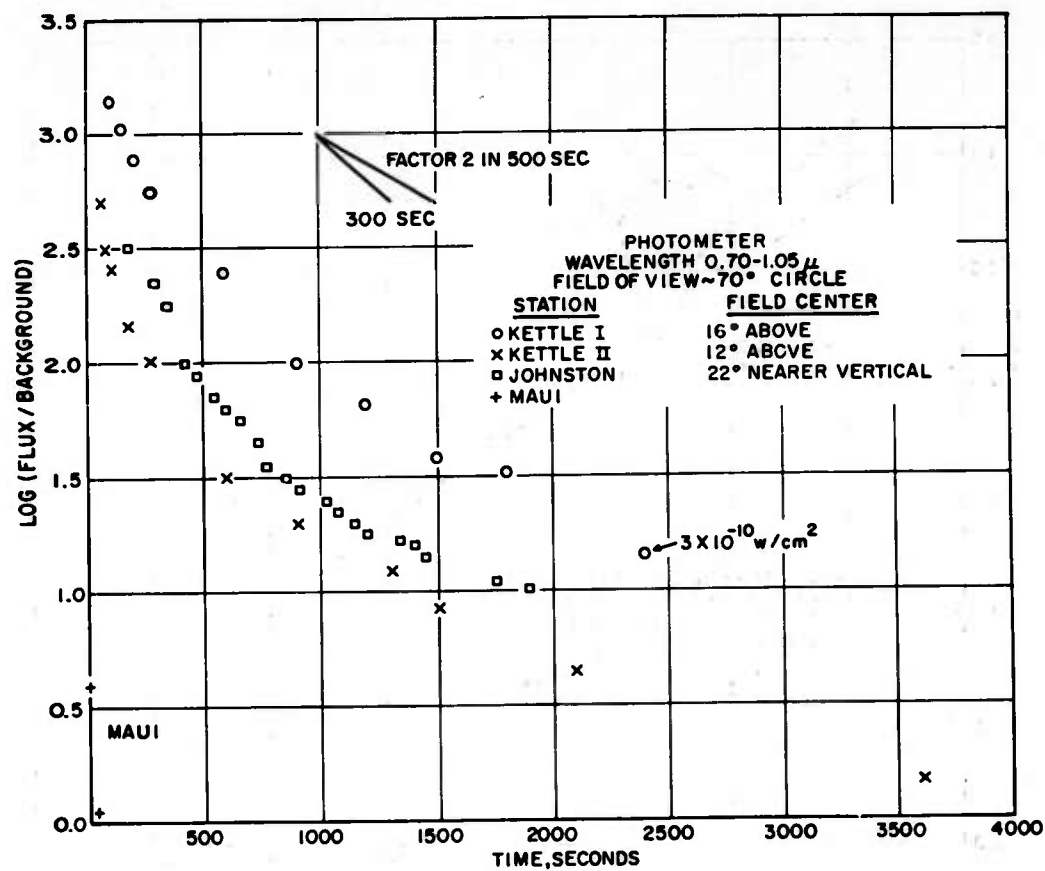


Figure 3.358 Near-IR photometer results from all stations,  
Blue Gill Triple Prime.

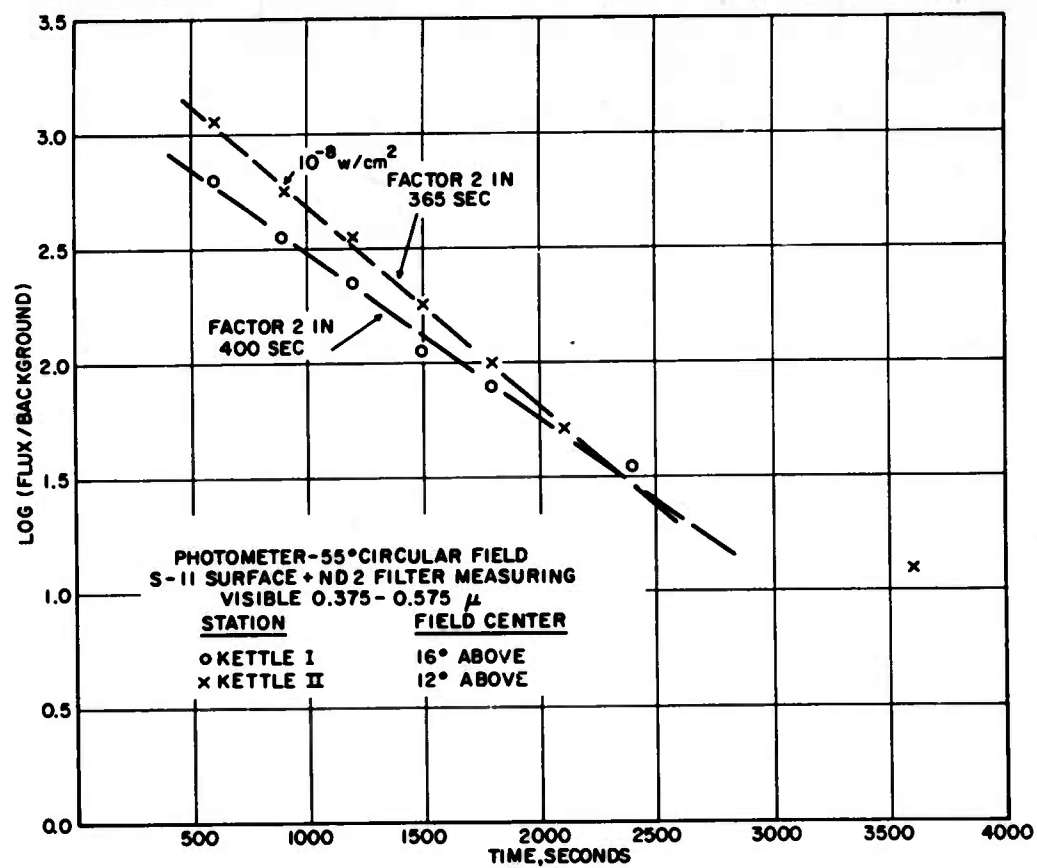


Figure 3.359 Visible photometer results from aircraft stations, Blue Gill Triple Prime.

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